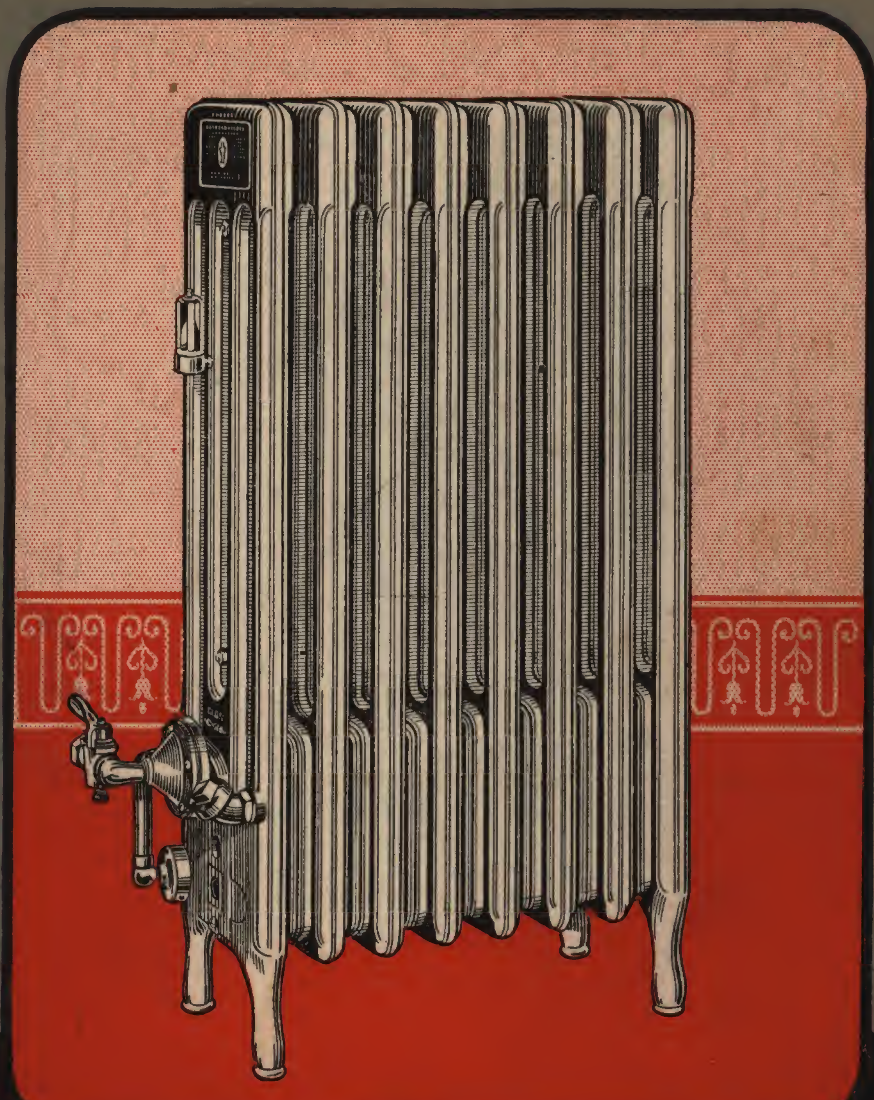
CLOW GASTEAM HEATING SYSTEMS



JAMES B. CLOW & SONS
CHICAGO

Architects and Heating Engineers

CLOW GASTEAM HEATING SYSTEMS

Data Book

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BENJAMIN FRANKLIN WAS RIGHT!
BUT HE DIDN'T KNOW ABOUT GAS HEATING

FROM time immemorial until only 250 years ago, the progress in methods of heating buildings could be summed up in one word—"Chimney." From the days of Cro-Magnon man, living in caves, eating the uncooked flesh of wild beasts, to the glory and brilliance of France in the time of Louis XIV, there was no essential improvement in so vital and indispensable a human art as warming buildings, save for so obvious a device as the chimney to carry out smoke. It remained for Benjamin Franklin, the "Greatest American," to invent a stove in 1774 which to this day remains the most important contribution to heating ever recorded in history. The purpose of his stove, Franklin explained, was to "distribute heat all over the room, without roasting the face and freezing the back."

How Primitive Man Warmed Himself

The cave man's heating plant consisted of an open fire at the mouth of the cave. The fire kept savage beasts outside, and a small part of the heat developed—perhaps as much as 1%—actually served as protection against the bitter winter cold. Some of the smoke got outside the cave, a goodly part remained inside. Frequently, when the fire died, the man died, because he could not always kindle a new one.

Ancient Heating Plants

The Egyptians and Greeks found protection against the cold by using pans or braziers filled with live coals placed on the floor in the middle of the room. The Romans tackled the job of heating their grand palaces in characteristic fashion. They built huge subterranean furnaces (Hypocausts) from which heat was conducted through clay pipes placed in the walls and floors, and eventually was transmitted from the heated floors and walls to the room air. The difficulty was that it took a couple of months for the heating plant to get under way. And once hot, it took months to cool off. There were other drawbacks to this system. And a hypocaust had a way of burning down the palace.

Poor Queen Guinevere

When good King Arthur ruled the land of Merrie England life was not what it is now cracked up to be. For instance, to heat their bleak stone castles, Arthur and his good queen, Guinevere, had to be content with fireplaces. They were about as effective as a bon fire heating the Yale Bowl in January. Obviously poor Queen Guinevere could not have appeared at Court functions in the dead of winter attired in filmy silks. A severe trial of her fortitude indeed!

The Franklin Stove

From the Middle Ages to the American Revolution there was virtually no progress in heating methods. A fireplace and chimney served prince and pauper alike, "roasting the face and freezing the back." The quaint charm of an open wood fire hardly offsets the discomfort, dirt, and fire hazard inevitable with this form of heating.

So Franklin built his famous stove, causing a revolution in house heating. Franklin took the fire out of the fireplace, locating it in an enclosed iron grate, a certain distance away from the wall. This arrangement had the great advantage of causing the heat developed to be distributed more or less evenly throughout the room, instead of up the chimney. It produced heat at the point where it was needed. It decreased fire hazards. Despite its shortcomings, Franklin's stove embodies the most practical and scientific principles of house heating yet known.

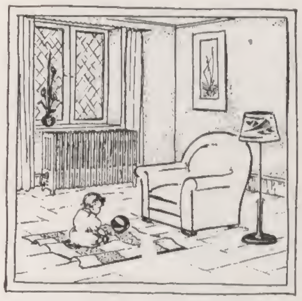
But there were some drawbacks. Crude fuels, the only ones available at that time, were very dirty. Ashes, smoke and soot fouled the air of a fine lady's chamber and ruined her carpets and drapes. Then, too, there were the nuisances of storing fuel and replenishing it in the stove. **Had Franklin known**

about gas fuel, these drawbacks could have largely been avoided.

Had Franklin known of the advantages of steam heat and introduced this into his stove as the medium for heating the air in the room, he would have closely approached the modern heating system—Clow Gasteam radiators.

Franklin realized fully the economy of creating heat where it was needed. The central heating plant has great economic drawbacks—very important considerations when gas is used as a heating fuel. To heat one or two rooms—to furnish heat in morning or evening—the entire plant must be started up. There are heavy losses up the chimney—there are large losses in transmission pipes—and the cost of installation is high.

Gasteam—The Ultimate in Heating



In order to apply Franklin's principle to steam heating, using gas for fuel, the Clow Gasteam Heating System was designed. Each radiator is an entire heating unit—like the Franklin stove—but gas is used for fuel, clean, and requiring no storage space. Steam is developed in a cast iron radiator, giving the best distribution of the heat throughout the room heated. Clow Gasteam radiators combine the best form of heating (steam) with gas fuel—economically—for the largest building or the smallest room.

You Can Heat Best with Gas Using Clow Gasteam Radiators

Steam heat circulated by the use of cast iron radiators is not only the economical method of heating, but also, when properly controlled, the most healthful. The iron of the radiators is heated by the steam, and the air passing over this iron is heated to a comfortable temperature, and evenly circulated throughout the room.

Clow Gasteam combines GAS, the ideal fuel, with STEAM, the ideal heat—and through economical unit control brings steam heat with gas within the reach of everyone—for the largest building or the smallest room.

Clow Gasteam Radiators—Steam Heat with Gas

A glance at the sectional drawing of a Clow Gasteam radiator on page 5 shows its construction and explains its operation. To the casual observer, it looks like an ordinary cast iron radiator. At the bottom, however, entirely enclosed in cast iron, is a gas burner. Directly above this is a small body of water. The burning gas gets up steam, which circulates through the entire radiator. The steam pressure operates an automatic regulator on each radiator, which maintains a correct steam pressure.

Nothing could be more simple. There are no parts to get out of order. All materials used last indefinitely. Each radiator is a complete unit, giving steam heat, when and where you want it.

The advantages of Gasteam over other methods of burning gas are very evident. As far as the first cost is concerned, the central heating plant and large steam pipes are eliminated. The only piping now required is a small gas pipe to each radiator. The labor cost of installation is low. Large losses of heat up a chimney and through a circulating system are eliminated—you get the greatest possible efficiency from the fuel burned.

Unit Operation Greatest Economy

One of the greatest economies, however, comes from the fact that you have heat only when and where it is needed. You don't have to run a central plant to give heat to just a few rooms. This provides greatest economy in the spring and fall. In some types of buildings no heat whatever is required after six o'clock. Clow Gasteam is a permanent, well appearing, efficient, economical healthful heating system that brings gas heating within the reach of everyone.

Correct Heat Distribution

Clow Gasteam radiators radiate heat in every direction, downward, upward, and sideways. They circulate large volumes of air at medium temperatures. Very large heating surfaces—as much as 100 square feet for an ordinary radiator—make this possible.

There is no "scorched air", or "spotlight" heating with Clow Gasteam. Healthful, comfortable, steam heat in every portion of the room—that's what you can have with Clow Gasteam radiators.

The Final Test

Clow Gasteam radiators have been produced for 29 years. They are sold in nearly every city in the United States, by our representatives, by Gas Companies, or by recognized plumbers. You can be shown Gasteam installations and operating costs for any type of building in which you may be interested.

Clow Gasteam radiators are approved by the American Gas Association, and by the laboratories of many leading gas companies, and the City Health Departments throughout the country. They are listed as standard by the National Board of Fire Underwriters Laboratories. See pages 42–43.

Not every so-called gas radiator is a Clow Gasteam radiator. Make sure that your radiator is a Clow Gasteam radiator, manufactured by James B. Clow & Sons (Established 1878), the original and largest manufacturer of gas-fired steam radiators.

RADIATOR CONSTRUCTION AND OPERATION

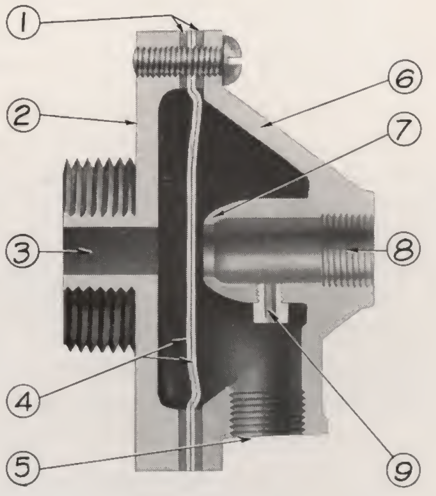
Clow Gasteam radiators are constructed of cast iron. The sections are fitted together with slip nipples, and held firmly in place by tie rods. The upper part of the sections forms the radiating surface. Directly beneath the radiating surface is the water chamber which holds a body of water one inch deep. The combustion chamber located below the water chamber is an integral part of the radiator sections and encloses a gas burner. The sections at the combustion chamber are lap jointed, entirely enclosing the gas flame.

Freezing of the water will not damage the sections. The construction of the water chamber provides sufficient space for free expansion.

Automatic Steam Pressure Control

The volume of gas supplied to the burner is controlled by an automatic regulator actuated by the pressure of the steam. When steam pressure of from 5 to 8 pounds has been generated in the radiator, the volume of gas is automatically reduced to the amount required to maintain this pressure. Thus, a minimum amount of gas is used to keep the radiator hot and to maintain even room temperature.

1—Permanite gaskets
2—Steam side of regulator
3—Steam inlet
4—Double metal diaphragms
5—Gas outlet to burner
6—Gas side of regulator
7—Regulator seat
8—Gas inlet to regulator
9—By-pass orifice



When the radiator is turned on, the gas enters the regulator through the inlet (8). There being no steam pressure in the radiator, the gas flows between the diaphragm (4) and the seat (7), the gas continuing down through the outlet (5) to the radiator. The gas enters the burner through a main orifice in the orifice ell (see D on opposite page). This main orifice controls the size of the flame when gas is first lighted.

After the gas has been burning long enough to build up five to eight pounds steam pressure, the pressure transmitted through the connection (3) forces the diaphragms (4) tightly against the seat (7). The supply being thus shut off at this point (7), the gas must then flow through the by-pass orifice (9). The reduced gas supply, determined by the size of the opening in the by-pass orifice (9), is just sufficient to maintain a steam pressure in the radiator necessary to keep the diaphragms (4) against the seat (7). Therefore, the size of the opening in the by-pass orifice (9) varies according to the heating capacity of the radiator, and the heating value and gravity of the gas supplied.

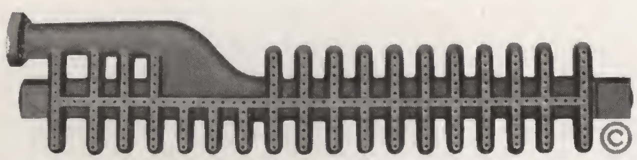
The diaphragm (4) facing the steam side of the regulator (2) is of special phosphor bronze. The other diaphragm, facing the gas side (6) is made of special non-corrosive alloy, making it entirely impervious to the action of any impurities commonly occurring in fuel gas. The double diaphragms are a safeguard against the possibility of gas entering the steam chamber, or steam entering the gas pipe.

Safety Valve

The safety valve prevents excessive steam pressure in the radiator, resulting from unusually high gas pressure, or from covering the radiator with clothing or bedding, or any other circumstance which would interfere with the normal operation of the radiator.

Gas Burners

The burners in Clow Gasteam radiators are designed to secure highest efficiency with complete combustion. The Bunsen burner operates equally well on all grades of manufactured and natural gas.



Bunsen Burner, Designed according to the Specifications of the U. S. Bureau of Standards.

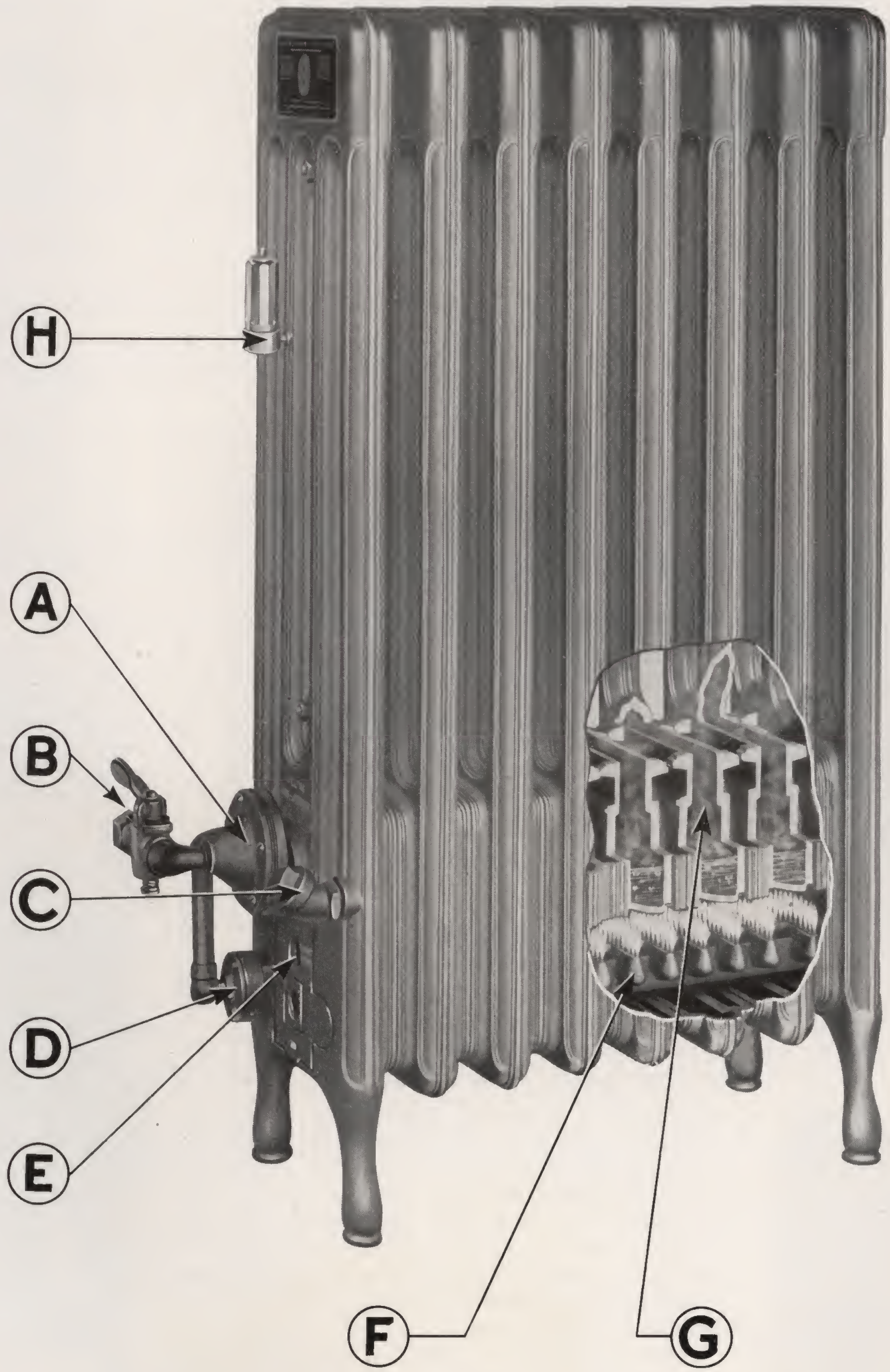
Automatic Air Valve

The automatic air valve (H) permits air in the radiator when cold to be forced out as steam is generated. The air valve remains open as long as it passes air, closing when steam comes in contact with the valve. Successful operation of the radiator depends much upon the elimination of all air after steam pressure builds up.

Adjustments

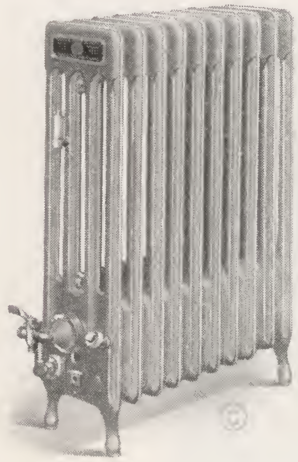
Each Clow Gasteam radiator, before leaving the factory, is carefully tested and inspected under actual working conditions. The main and by-pass orifices in each radiator are sized to conform to the heating value and pressure of the gas in the localities where the radiators are to be installed. Where gas pressure varies considerably, or exceeds 7 inches, gas pressure regulators are necessary. The only adjustment after installation is the regulation of the air shutter, which should be so adjusted that the gas will burn with a soft blue flame.

RADIATOR CONSTRUCTION AND OPERATION



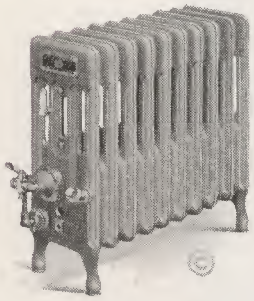
(A) Automatic Steam Regulator (B) Gas Cock (C) Filling Cup (D) Main Orifice Ell
(E) Lighting Opening (F) Burner (G) Steam Columns (H) Air Valve

UNVENTED RADIATOR PRICES AND RATINGS



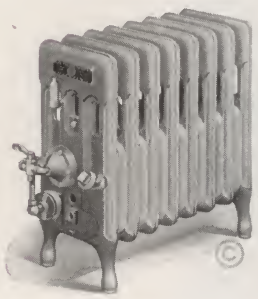
Four Columns 38 Inches High—4, 6, 8, 10, 12 and 15 Sections

No. of Sections	4	6	8	10	12	15
*B. T. U. per hr. Delivery	8000	12000	16000	19200	23170	28800
Equiv. sq. ft. of Radiation	32	48	64	80	96	120
Length less Gas Cock Inches	13	18	23	28	33	40½
Approx. Shipping Wt. Lbs	173	255	333	412	485	605
Code Word	Gumby	Gunner	Gurdle	Gurlet	Gurton	Gusset
**List Prices	$46.00	$60.00	$72.00	$84.00	$96.00	$115.00



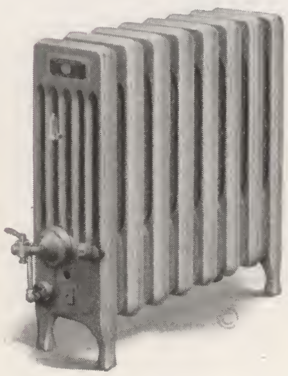
†Four Columns 26 Inches High—4, 6, 8, 10, 12 and 15 Sections

No. of Sections	4	6	8	10	12	15
*B. T. U. per hr. Delivery	6200	8250	10300	12400	14400	18000
Equiv. sq. ft. of Radiation	20	30	40	50	60	75
Length less Gas Cock Inches	13	18	23	28	33	40½
Approx. Shipping Wt. Lbs.	135	194	248	300	357	447
Code Word	Guilty	Guitar	Gulch	Gulf	Gullet	Gulp
**List Prices	$40.00	$49.00	$58.00	$67.00	$76.00	$93.00



†Four Columns 22 Inches High—4, 6, 8, 10, 12 and 15 Sections

No. of Sections	4	6	8	10	12	15
*B. T. U. per hr. Delivery	3400	4800	6100	7400	8800	10800
Equiv. sq. ft. of Radiation	12	18	24	30	36	45
Length less Gas Cock Inches	13	18	23	28	33	40½
Approx. Shipping Wt. Lbs.	113	160	210	250	298	368
Code Word	Guard	Guardian	Guava	Guest	Guide	Guild
**List Prices	$38.00	$47.00	$56.00	$65.00	$74.00	$86.00



Six Columns 31 Inches High—2, 3, 4, 5, 6, 7, 8, 9 and 10 Sections

No. of Sections	2	3	4	5	6	7	8	9	10
*B. T. U. per hr. Delivery	6720	9600	12720	15600	18500	21400	24200	27100	300.00
Equiv. sq. ft. of Radiation	28	40	53	65	77	89	101	113	125
Length less Gas Cock Inches	10	13¾	17½	21¼	25	28¾	32½	36¼	40
Approx. Shipping Wt. Lbs.	105	152	194	238	284	330	375	421	467
Code Word	Go	Goad	Goblet	Gon-dola	Gore	Goth	Govern	Gowk	Gown
**List Prices	$37.00	$44.00	$50.00	$58.00	$66.50	$73.00	$82.00	$88.50	$97.00

See page 9 for roughing-in details.

*The B. T. U. Ratings shown are generally higher than the nominal square foot ratings, since the latter are the nearest whole number of sq. ft. per section times the number of sections.

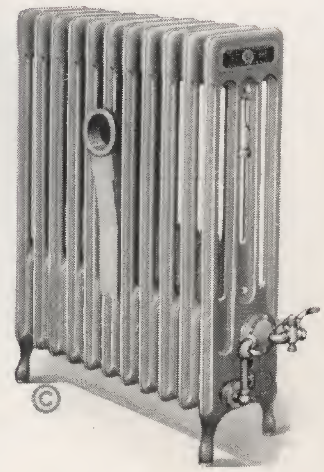
**If with lighter tube and lighter cock add $1.20

†This radiator has heat deflector cast integral between sections, and must be connected with trimmings at the left as you face the radiator, unless burner and regulator are reversed to right-hand side of the radiator.

VENTED RADIATOR PRICES AND RATINGS

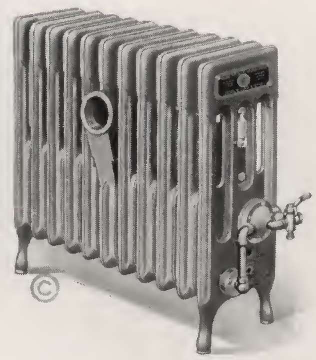
Four Column 38 Inches High—5, 7, 9, 11, 13, 15, 20 and 25 Sections

No. of Sections	B. T. U. per Hr. *Delivery	Equiv. Sq. Feet of Radiation	Length Less Gas Cock Inches	Approx. Shipping Wt. Lbs.	Code	**Prices
5	6,920	28	15½	227	Venal	$56.00
7	9,700	39	20½	306	Vendor	69.00
9	12,000	50	25½	382	Veneer	82.00
11	15,000	61	30½	463	Venom	95.00
13	17,500	72	35½	543	Venture	108.00
15	20,000	83	40½	625	Venus	121.00
20	26,400	110	53	860	Verbal	153.50
25	32,900	137	65½	1090	Verdant	186.00



Four Column 26 Inches High—5, 7, 9, 11, 13, 15, 20 and 25 Sections

No. of Sections	B. T. U. per Hr. *Delivery	Equiv. Sq. Feet of Radiation	Length Less Gas Cock Inches	Approx. Shipping Wt. Lbs.	Code	**Prices
5	4,100	15	15½	166	Volar	$50.00
7	5,400	21	20½	220	Voley	59.00
9	6,800	27	25½	275	Volga	69.00
11	8,100	33	30½	329	Volt	79.00
13	9,500	39	35½	384	Volute	89.00
15	10,800	45	40½	435	Volume	97.00
20	14,400	60	53	634	Vortex	120.50
25	18,000	75	65½	794	Voter	144.00



See Page 9 for Roughing-In Details

*See note on B. T. U. rating, bottom page 6.

**Above prices do not include vent bushings which must be used if sheet metal flue is to be attached. See page 13, A-6755, for price of bushing.

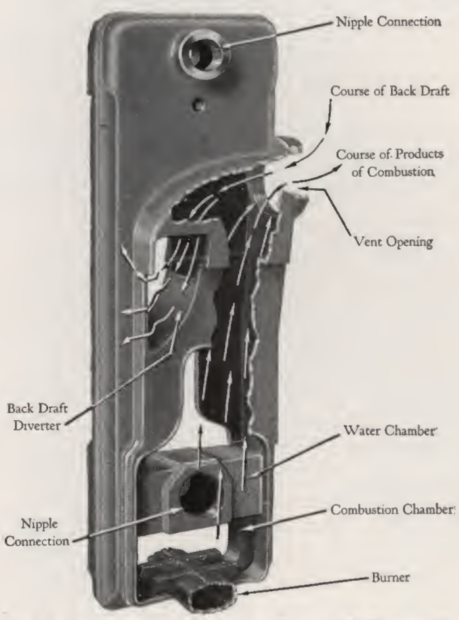
The outside diameter of vent opening is $4\frac{1}{4}''$. The inside diameter is $3\frac{5}{16}''$ and is tapped to take 3-inch standard iron pipe. See page 9 for roughing-in measurements.

Above list prices include automatic air valve, extra heavy gas cock and safety valve.

If with lighter tube and lighter cock add to above list prices $1.20.

Luminous flame burners for the above can be supplied. Price furnished on application.

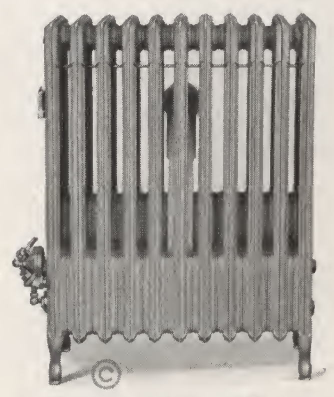
Special Integral Cast Center Vent Section (Patented)



Special Vent Section showing Integral Down-Draft Diverter and Course of the Products of Combustion

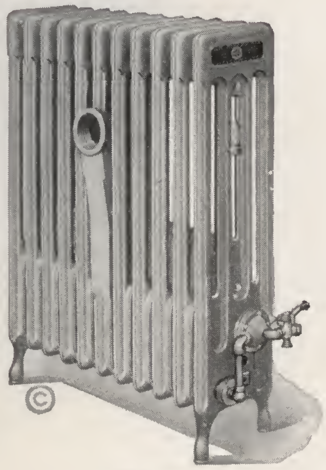
In the Clow Vented Gasteam Radiator the products of combustion are collected in the built-in combustion chamber, and are exhausted through the special center section. This section is provided with an outlet for a connection to be made to the vent stack so as to carry to the outside all products of combustion.

An exclusive Gasteam feature is the down draft diverter, illustrated at left, which is cast integral with the special center section. It is so positive a diverter that a down or up draft of the highest velocity will not in any way disturb the flame of the burner. No moving parts and cast iron construction insures against wear or corrosion.

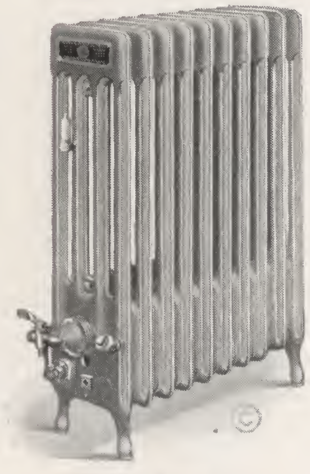


Front View of Vented Radiator

APPLICATION OF VENTED AND UNVENTED RADIATORS



Vented
Clow Gasteam Radiator



Unvented
Clow Gasteam Radiator

Moisture An Important Consideration

When gas is burned in any appliance water vapor is produced.

It is possible for too much humidity to accumulate in the air of a heated room, and for the moisture to condense on windows and exposed walls. This is due to the fact that heated air can hold more moisture than cold air. Heated air coming in contact with cold windows and walls is cooled. If it contains a high percentage of humidity, when cooled, condensation generally results. When heating with unvented radiators humidity is added to the air in direct proportion to the heat loss of the rooms heated. The air change that occurs in various amounts in any heated building, carries out with it both heat and moisture. The heat loss from conduction through windows, cold walls, floors, ceilings, etc., takes no moisture along with it as it escapes from the building. Therefore, the moisture liberated in a room when the heat was made remains behind. If the air that is leaving the room cannot absorb this additional moisture, the amount of humidity steadily increases until condensation takes place on cold surfaces, such as windows and cold walls.

With vented Clow Gasteam radiators the moisture produced by the burning of fuel gas is carried to the outside of the building through vent stacks. When all vented Gasteam radiators are used on an installation, there is no humidity from the radiators added to the heated room air, and a very dry condition results. This may be desirable in some cases, as when large show windows must be kept free from frost in cold weather.

Air Change Heat Loss vs. Conduction Heat Loss

Where the heat loss due to air change approximately equals the heat loss by conduction through walls, windows, etc., it is unlikely that any moisture will condense on the glass, or walls, except in zero or subzero weather. On the other hand, if the heat loss due to conduction through walls, windows, etc., is four or five times the amount of the heat loss from air change, it is almost certain that condensation will occur, except in dry, mild climates.

The large variation in the ratio between the heat loss from air change to the heat loss by conduction through walls, windows, etc., depends upon the tightness and the materials used in the construction of the building, as well as the use to which it is to be put. For example, in a schoolroom, auditorium or restaurant, provision is ordinarily made for a relatively high air change. In dwellings where insulated walls and ceilings and storm windows are provided, the conduction losses often are small enough so that they amount to no more than the heat loss from one air change per hour.

On the other hand, if the building is comparatively tight, so that normal air change is not more than one per hour, and there is a large exposure of glass, and the walls themselves are of a construction which permits large heat loss, then the ratio of the conduction loss to the air change loss is high. In this case it is almost certain that moisture will condense on the windows unless part or all of the Gasteam radiators installed are vented.

An intelligent selection of vented and unvented Clow Gasteam radiators, taking the above factors into consideration, will result in the prevention of excess moisture conditions.

General Recommendations

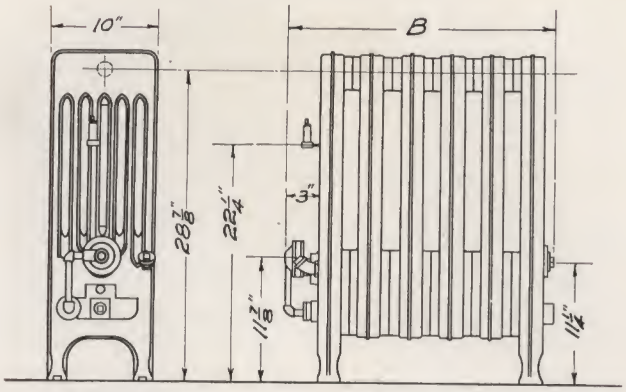
As a general rule, it may be said that all unvented Gasteam radiators may be installed in mild, dry climates, except under very unusual conditions.

In cold and very damp or damp and very cold climates, practically the entire number of radiators in any installation should be vented.

In climates that are neither very cold or very damp, installations of part vented and unvented radiators prove entirely satisfactory.

The proportion of vented to unvented radiators in any installation should be determined by considering three main factors, FIRST, the ratio of air change heat loss to conduction heat loss, SECOND, the prevailing normal humidity, and THIRD, the severity of the winter weather.

INSTALLATION—ROUGHING-IN MEASUREMENTS



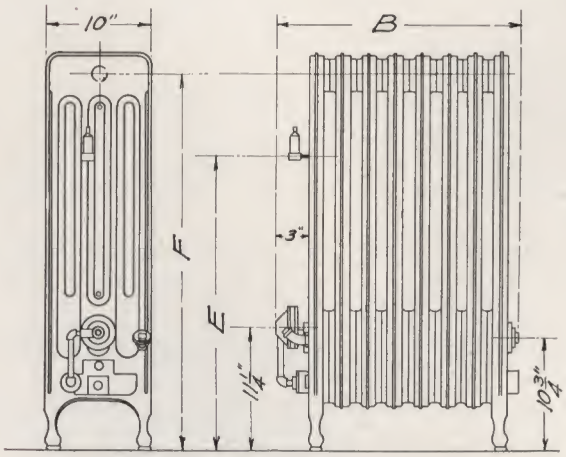
END VIEW. FRONT VIEW.

Six Column "Gothic" Unvented
31 Inches High

No. of Sec.	2	3	4	5	6
Dimension "B"	10	13¾	17½	21¼	25

No. of Sec.	7	8	9	10
Dimension "B"	28¾	32½	36¼	40

Dimensions in inches.



END VIEW. FRONT VIEW.

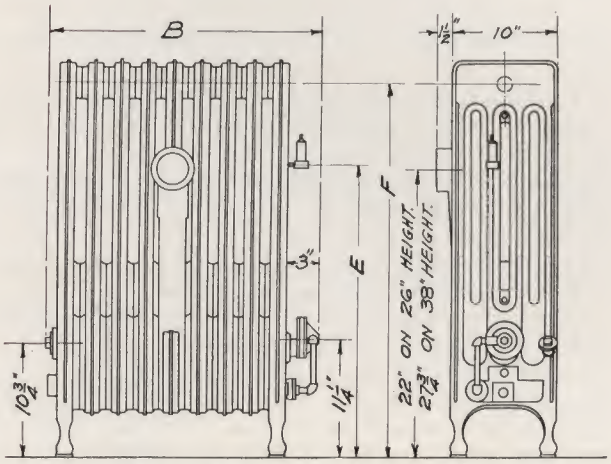
Four Column "Colonial" Unvented
22-26-38 Inches High

No. of Sec.	4	6	8
Dimension "B"	13	18	23

No. of Sec.	10	12	15
Dimension "B"	28	33	40½

Dimension	E	F
38"	27¼	35⅜
26"	18⅛	23½
22"	16½	19½

Dimensions in inches.



REAR VIEW END VIEW.

Four Column "Colonial" Vented
26-38 Inches High

No. of Sec.	5	7	9	11
Dimension "B"	15½	20½	25½	30½

No. of Sec.	13	15	20	25
Dimension "B"	35½	40½	53	65½

Dimension	E	F
38"	27¼	35⅜
26"	18⅛	23½

Dimensions in inches.

INSTALLATION—SPECIFICATIONS AND INSTRUCTIONS

Gas Piping

The piping rules of the city or of the gas company should be adhered to.

To insure the most satisfactory and efficient operation of the CLOW GASTEAM HEATING SYSTEM it is essential that the GAS PIPES and GAS METER be of adequate size to supply a SUFFICIENT quantity of gas to each radiator without too great a drop in the gas pressure. We suggest the use of the maximum lengths and sizes for the various amounts of radiation as computed in the following table where gas company tables are not available.

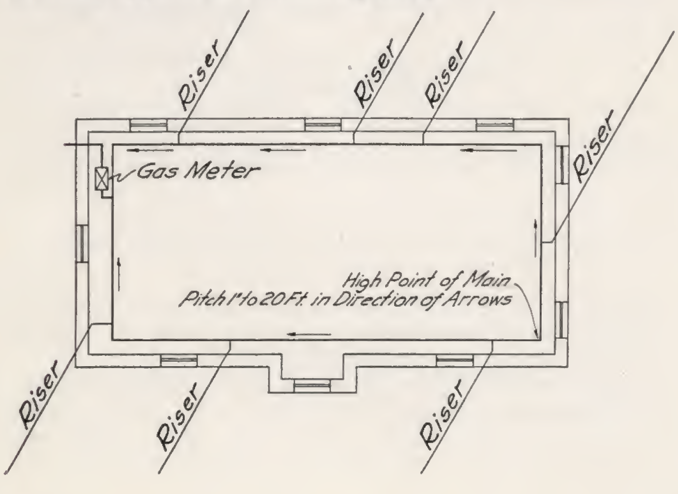
THE CAPACITY OF GAS PIPES COMPUTED IN SQUARE FEET OF VENTED GASTEAM RADIATION

Length of Pipe	DIAMETER OF PIPE								
	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
10	80	160	400	640	1040	2080	3600	5600	12,000
20	60	150	380	600	1000	1920	3200	5280	11,200
30	40	140	370	560	960	1760	3040	4960	10,720
40		130	340	540	880	1600	2880	4640	9760
50		120	300	500	800	1480	2800	4480	9280
60			270	440	740	1400	2400	4160	8320
70			240	400	700	1280	2280	3840	7680
80				380	660	1200	2200	3520	7360
90				360	600	1120	2000	3200	6880
105				320	560	1040	1880	2880	6080
120					520	1000	1760	2720	5760
135					480	960	1680	2600	5440
150					400	920	1640	2520	5120
165						880	1560	2360	4800
180						840	1440	2240	4640
210						800	1320	2080	4320
250							1200	1920	4160
275								1760	3840
300								1600	3520
375									3200
450									2800

Do not use a pipe of greater length than it is computed for.

Looped Piping Plan

To insure an equal pressure and supply to all risers, we recommend for all installations of ten or more radiators that the main gas distributing line in the building be looped in the basement at the ceiling as shown in the following diagram:



Gas Piping Specifications

1. All gas piping to be run as shown on plans.

1a. The building structure shall not be weakened by the installation of piping.

2. The main distributing gas lines shown must be of not less than______inch standard steel pipe and must be connected so as to form an unbroken loop. (See illustration.)

3. The main gas distributing loop line must be run close to the basement ceiling and not concealed.

4. All risers and drops are to be concealed.

5. Run a______inch gas line from gas meter location to and connected with main gas distributing loop line.

6. All gas risers supplying three (3) outlets must be not less than one (1) inch standard steel pipe; supplying two (2) outlets must be not less than three-fourths (¾) inch standard steel pipe; and supplying one (1) outlet must be not less than one half (½) inch standard steel pipe.

7. All gas drops supplying two (2) outlets must be not less than three-fourths (¾) inch standard steel pipe, and supplying one (1) outlet must be not less than one half (½) inch standard steel pipe.

8. All gas outlets for radiators must be not less than one half (½) inch standard steel pipe.

9. **Obstructions in Pipe.** All piping must be free from burrs and other obstructions.

10. **Defective Material.** Split pipe or fittings repaired with cement or lead must not be used. Caulked fittings must not be used.

11. **Material not Allowed.** Unions or bushings must not be used in work that is to be concealed, and cast iron fittings are prohibited in either exposed or concealed work.

12. **Capping Outlets.** All outlets must be securely closed with iron caps until fixtures or appliances are installed.

13. **Piping on Outside Wall.** When it is absolutely necessary to run pipe on an outside wall a furring strip must be placed between the pipe and the wall.

14. **Piping on Masonry Walls.** All piping run on masonry walls must be securely fastened thereto by strapping it to wooden plugs driven into the wall.

15. **Imbedding in Concrete or Cement.** When pipe is to be imbedded in concrete or cement, it must be covered with tar paper or other suitable covering, or laid in a conduit pipe.

16. **Trapping Pipe.** To avoid trapping pipe, gas fitters must grade it to riser or to drops.

17. **Testing.** Before fixtures are installed, the piping must stand a pressure of six (6) inches on a column of mercury without showing any drop in the column for a period of ten minutes.

After fixtures are installed, piping must stand a pressure of six (6) inches on a column of mercury without showing any drop for the same period of time.

17a. The fitter shall assure himself that piping and appliances are fully purged before leaving the premises.

NOTE—Where natural gas or manufactured gas of fluctuating pressure is to be used include Paragraph 18.

18. Contractor must have installed between the gas meter and the main gas distributing line one______inch______adjustable gas pressure regulator, to be adjusted for an outlet pressure of 1 8/10 ounces for natural gas, or for an outlet pressure of 2½ inches for manufactured gas.

INSTALLATION—SPECIFICATIONS AND INSTRUCTIONS

Placing Radiators

1. Radiators must be level, with the back of the radiator not less than 4 inches from the wall. Placing the radiator closer to the wall does not permit free circulation of the air between it and the wall.

2. Radiator should be located on outside walls and near the windows, when possible. This helps to prevent cold drafts on the floor as the cold air that enters the windows and circulates from outside walls is warmed by the radiator before it is recirculated into the room.

3. The end of the radiator carrying the steam pressure regulator and filling cup should be at the installer's left hand as he faces the radiator and the wall beyond. This applies for all radiators except when specially assembled with the regulator and filling cup at the right-hand end. This can be done to avoid having the filling cup and gas cock in a corner or other inaccessible places.

4. Unless radiators have been ordered special with right-hand trim, they are furnished with the steam pressure regulator and filling cup on the left-hand as the installer faces the radiator and the wall beyond. Radiators (excepting 4-column 38-inch unvented and 6-column 31-inch unvented) **must** be installed in that position. If this brings the gas cock and lighter hole in a corner, interchange steam pressure regulator with 1¼-inch plug at opposite end of the radiator and reverse end plates and burner. All 26-inch and 22-inch unvented radiators are made with a deflector shield cast on the sections. They must face so that the heated air is directed away from the wall.

Connecting Gas Pipe

1. Use only steel pipe for the gas connections. Rubber tubing or other flexible connections should not be used as they often leak after short periods of service.

2. Install a union or a long screw coupling nipple in the gas line just ahead of the gas cock.

3. Lead the male fittings sparingly in connecting gas pipe. Female fittings should never be leaded.

4. Remove all scale and ream all pipe ends before connecting.

5. Test all fittings and joints for gas leaks after the gas is turned on.

6. We recommend that all gas piping used for Gasteam radiators be a separate system from that used to supply gas to other gas appliances. Where there is a fluctuating gas pressure, often the case with natural gas, a gas pressure regulator should be connected in the piping between the gas meter and the radiators. A gas pressure regulator will maintain an even gas pressure at all times.

CONNECTING VENT PIPE ON VENTED RADIATORS

1. Vented radiators are provided with a vent connection at the rear of the vent section.

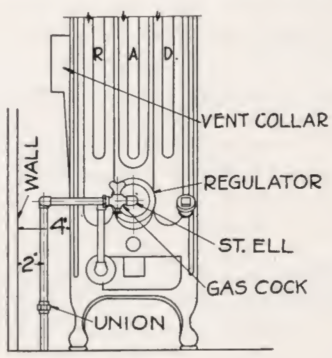
2. The opening on the vent section will accommodate 3-inch threaded pipe or either 3-inch or 4-inch sheet metal pipe by using the vent bushing shown on page 13.

3. When sheet metal pipe is used face the lap of the joints upward so that if condensation occurs in the pipe it will not drip from the joints.

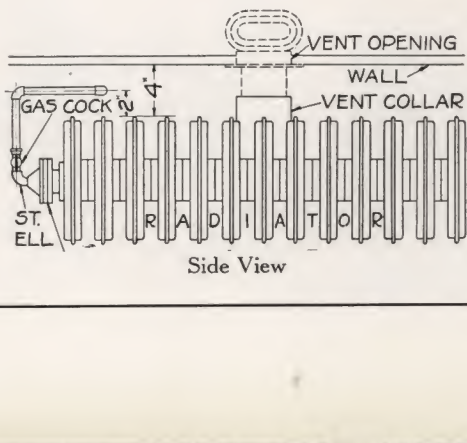
4. If threaded pipe is used make joints only hand tight, as there is no internal pressure in vent connections.

5. Grade any horizontal portion of the vent connection toward the chimney, when possible using a grade of about 1 inch to 10 feet.

Gas Connections to Radiators



Front View



Side View

METHODS OF RUNNING VENT STACKS

It is necessary to install vented radiators under certain climatic conditions, as explained on page 8. Various methods of installing vents have been found satisfactory for Clow Gasteam radiators. The more common are presented in the following pages. Typical specifications for each are given on pages 18 and 19. However, because of the wide variation in building codes, state laws and municipal ordinances, it is recommended that local requirements be consulted before planning and installing vent stacks.

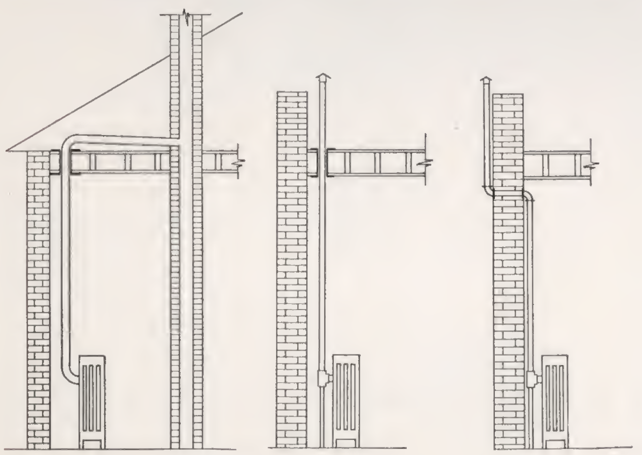
Venting into Chimneys

In buildings already provided with chimneys, previously used for coal burning appliances, it is frequently possible to connect the vents from a sufficient number of vented radiators into the existing chimneys. Wherever horizontal runs of vents are made, it is recommended that the piping should pitch downward toward the chimney 1 inch per 10 feet of horizontal run and that the horizontal portions be made as short as possible, and not to exceed 12 feet. In this method of venting standard 3-inch wrought iron pipe may be used for the vent connection from each radiator. Sharp turns in the pipe line should be avoided.

Vent connections to chimneys should always be insulated when they extend through cold rooms. Insulation always improves the draft even when the vent connection is installed in a heated room.

Exposed Vent Stacks

In commercial, industrial and other such buildings already completed, exposed vent stacks are frequently used, and are quite acceptable in appearance when decorated to match the wall or radiator. The illustrations below show three applications of exposed vents. Three-inch wrought iron piping is connected to the vented radiators and run to nearby chimneys, or through roofs, as indicated. A drip pocket is provided for each radiator at the base of the stack. For methods of going through ceilings and roofs see pages 14–16. Ventilator caps similar to those shown on page 16 are advisable to prevent down drafts and rain entering the outlets.



Radiator set on outside wall. Stack carried through ceiling and over to chimney, concealing horizontal run. Note pitch of horizontal pipe.

3-inch iron or steel pipe through roof, in one-story building. Note drip connection.

3-inch iron or steel pipe stack run through side wall.

Concealed "Ventum" Vent Stacks

For most installations requiring concealed vent stacks in 8-inch brick wall buildings, and brick veneer, or frame buildings, the use of "Ventum" pipe and fittings illustrated on page 13 are recommended. Round piping and fittings having the equivalent area of a three-inch pipe—necessary for satisfactory results—cannot be concealed in a 2x4 stud wall or partition. In selecting concealed piping it is important that the material will withstand the corrosive action of the products of combustion.

Cast iron "Ventum" pipe and fittings resist corrosion most successfully, and can be installed in 2x4 stud walls. They have sufficient cross-section area to allow for proper venting.

Tile Lined Vent Stacks

Tile vents constructed in brick walls are entirely practical. Illustrations of typical construction are shown on page 17. The tile vent stack replaces a center course of brick and is built in as the wall is constructed. Providing stacks of this type costs very little more than building the wall solid, and the stack lining is in no danger of corrosion.

No vent stacks should be provided in brick walls by merely omitting brick, without providing tile lining.

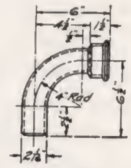
Outlets for tile stacks in brick buildings are best provided by carrying the tile to with 3 inches of capstone on the parapet and then leaving an opening to each side of the parapet wall. The capstone then acts as a down-draft deflector. This method is illustrated on page 17.

Mechanical Vent System

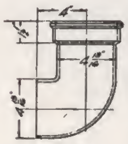
In buildings already constructed, where it is impractical to provide individual vents through the roof, and where horizontal runs of vent pipe to a chimney would be impractical, a mechanical system of venting with a draft produced by an exhaust fan has been successfully used. Full description is given on pages 20 to 27.

"VENTUM" OVAL STACK PIPE AND FITTINGS

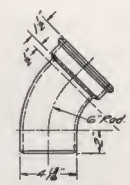
A-6750
Oval Vent Stack Pipe



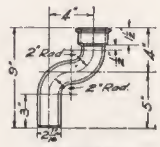
A-6758
Oval Quarter Bend



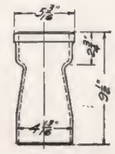
A-6769
Oval Quarter Bend



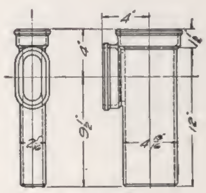
A-6760
Oval Eighth Bend



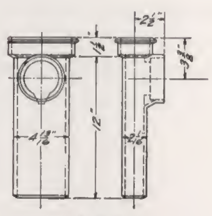
A-6764
Oval Offset



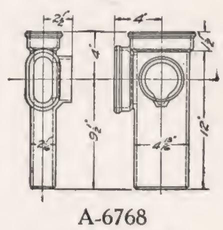
A-6762
Oval to Round Connector



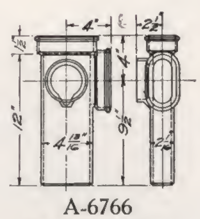
A-6765
Oval Drip Tee
Reversible Side Inlet



A-6752
Oval Drip Tee
Front Inlet
Closed at Bottom

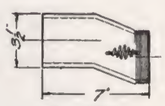


A-6768
Oval Drip Tee
Front and Left-Hand Side Inlets

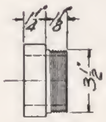


A-6766
Oval Drip Tee
Front and Right-Hand Side Inlets

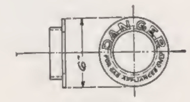
A-6756
Oval Cap



A-6770
Offset with Damper
Threaded 3-Inch I. P. S.
Without Damper A-6772



A-6755
Vent Bushing
Threaded 3-Inch I. P. S.



A-6754
Vent Collar

Clow "Ventum" Cast Iron Oval Vent Stack Pipe and Fittings were designed primarily for use with vented Clow Gasteam radiators. They have been found admirably adapted for many other uses, such as for venting gas stoves, water heaters, etc.† Ventum pipe and fittings were designed to provide for an adequately sized vent stack in a 2x4-inch stud wall without cutting the lath. Being oval in shape gives an area somewhat greater than a 3-inch soil pipe. It has been found that a vented Gasteam radiator must be provided with a stack equivalent to a 3-inch round pipe in order to vent properly.

Cast iron will not corrode from the action of the products of combustion, therefore "Ventum" stacks will last longer than the life of the building.

Prices and Weights

Figure ....Number	A-6750	A-6752	A-6754	A-6755	A-6756	A-6758	A-6760	A-6762
Approx. Weight, each...............Lbs.	21	9½	2	2½	2½	7	5	8½
Price.............................Each	2.10	2.10	.40	.95	.40	1.80	1.50	1.50
Figure ....Number	A-6764	A-6765	A-6766	A-6768	A-6769	A-6770	A-6772	
Approx. Weight, each...............Lbs.	7	10	10	9½	6	4	3½	
Price.............................Each	$1.80	2.20	$2.50	$2.50	$1.80	$2.00	$1.50	

Prices for A-6750 Vent Stack Pipe are for 3-foot lengths. We do not cut lengths.

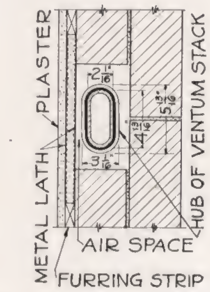
*The A-6762 Oval to Round Fitting shown has an oval spigot and a bell 3-for inch Standard Soil Pipe.

†"Ventum" pipe is designed to carry the products of combustion from 100 cu. ft. per hour of manufactured gas, or 50 cu. ft. per hour of natural gas.

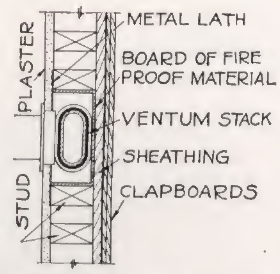
INSTALLATION OF "VENTUM" VENT STACKS

For most installations we recommend "Ventum" pipe and fittings shown on page 13. Cast iron will not corrode under the action of the products of combustion, and the special pipe indicated is designed to go into walls as narrow as $3\frac{1}{2}$ inches without necessitating expensive fittings. The drip tee is particularly designed to prevent any back flow of moisture. The special fittings give a sufficient latitude for any requirements, and in practice cast iron has proven highly efficient and economical for use as stacks.

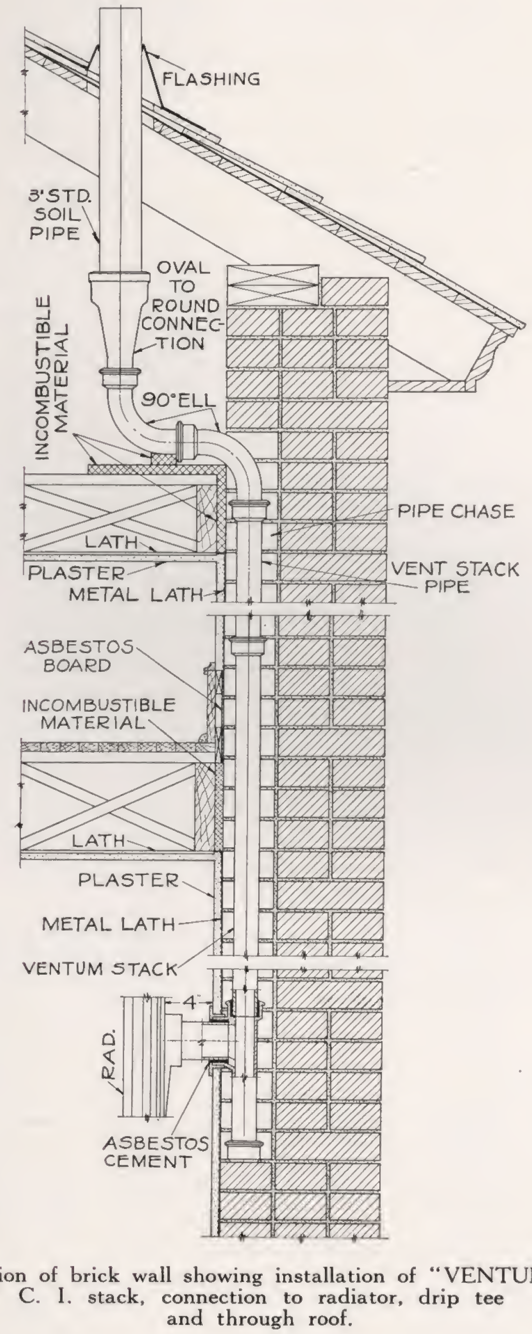
The details below illustrate the construction of "Ventum" cast iron stacks in brick walls, and in frame walls using 2x4 inch studdings, the latter also answering for brick veneer and stucco-frame walls.



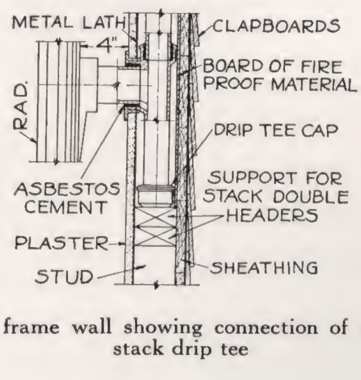
Plan of brick wall showing installation of "VENTUM" stack and double thickness of metal lath and plaster



Plan showing "VENTUM" stack in frame, brick-veneer or stucco-frame construction



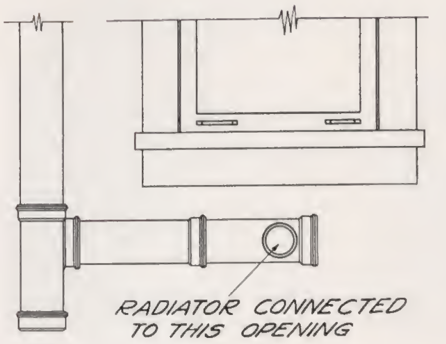
Section of brick wall showing installation of "VENTUM" C. I. stack, connection to radiator, drip tee and through roof.



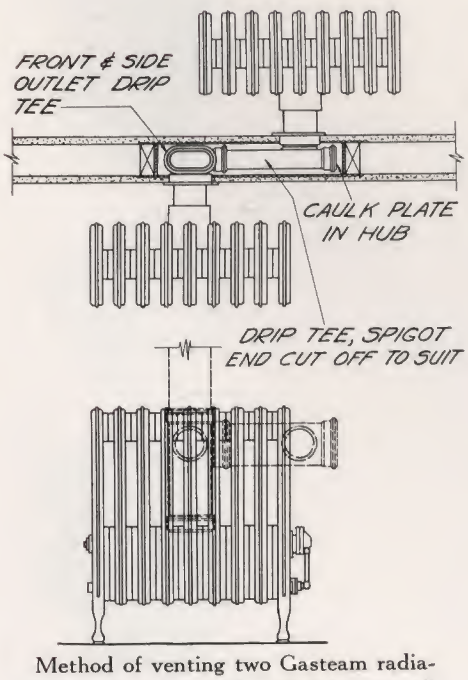
Section of frame wall showing connection of radiator to stack drip tee

For methods of flashing and venting through wall see page 16.

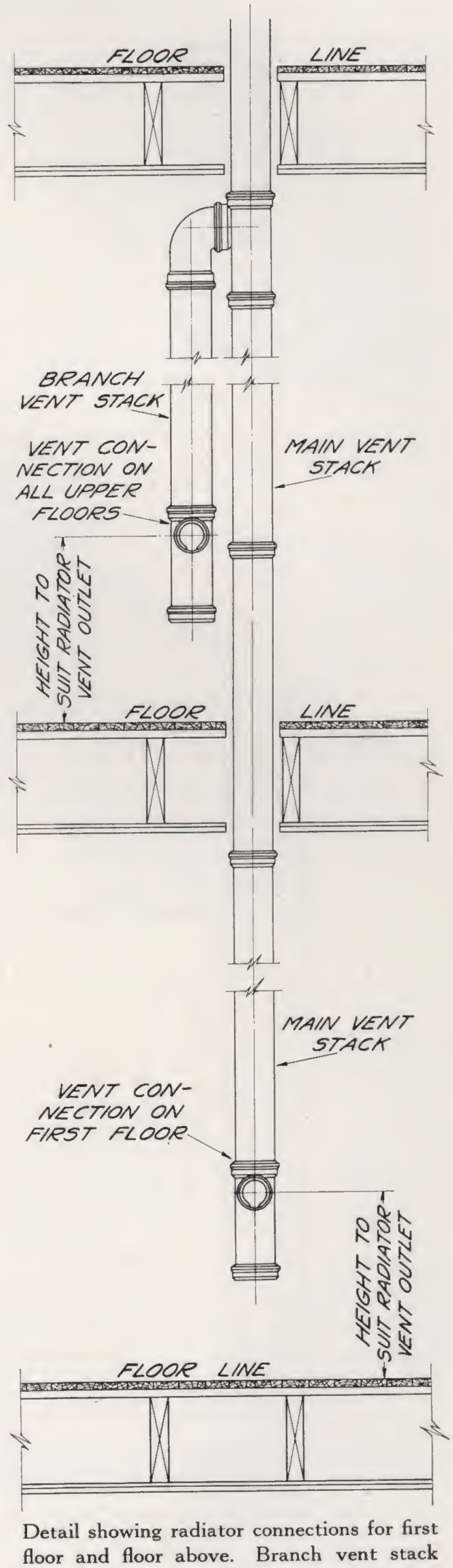
INSTALLATION OF "VENTUM" VENT STACKS



Method of venting a Gasteam radiator located under a window into stack at left. (Brick construction)

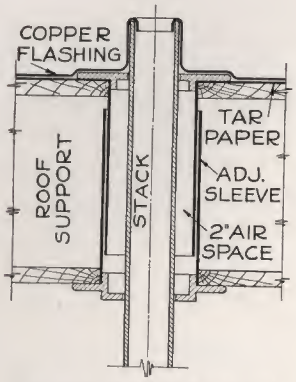


Method of venting two Gasteam radiators on opposite sides of interior wall into one vent stack



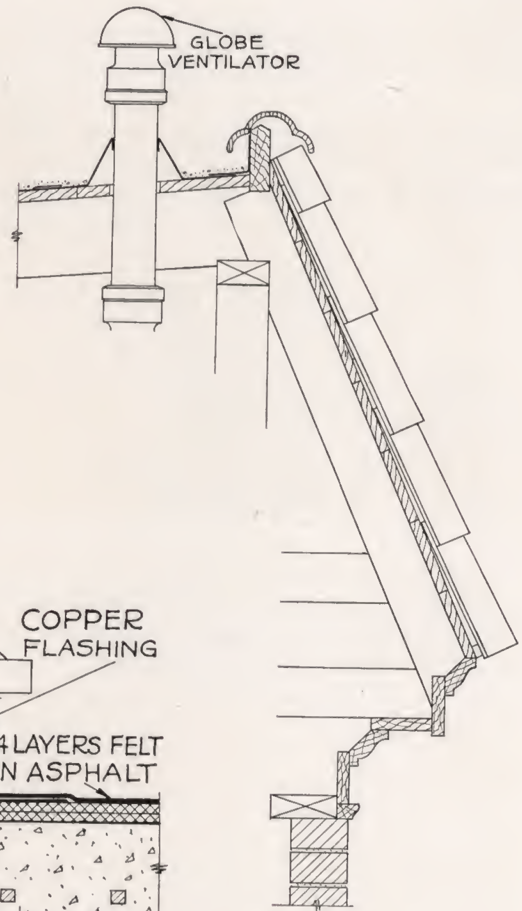
Detail showing radiator connections for first floor and floor above. Branch vent stack enters main vent stack using side outlet tee

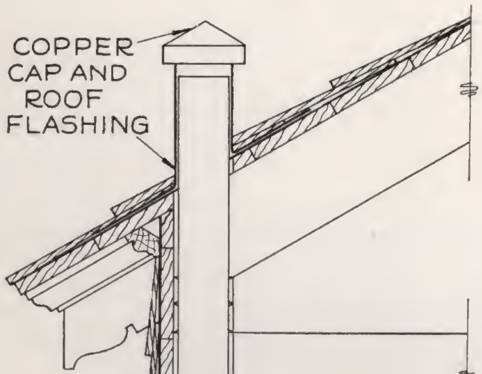
MISCELLANEOUS GASTEAM VENT STACK DETAILS



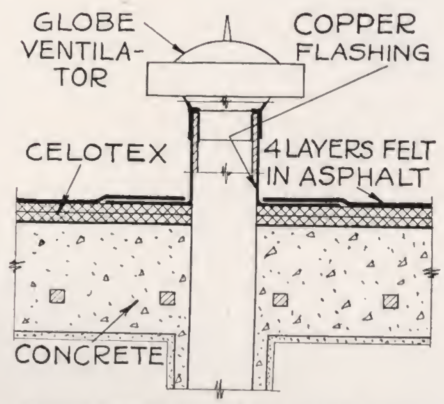
The most approved method of going through roof with sleeve

Right—
Type of roof upon which stack pipe outlets appear inconspicuous. The ventilator cap is well chosen, harmonizing with the roof design.

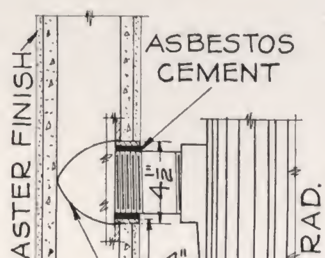




Frame wall with tile stack encased in galvanized iron casing
Section of wall at vent stack
Joints in casing should not come opposite joints in tile



Round iron pipe stack in concrete roof. Method of going through roof, showing flashing and ventilator cap

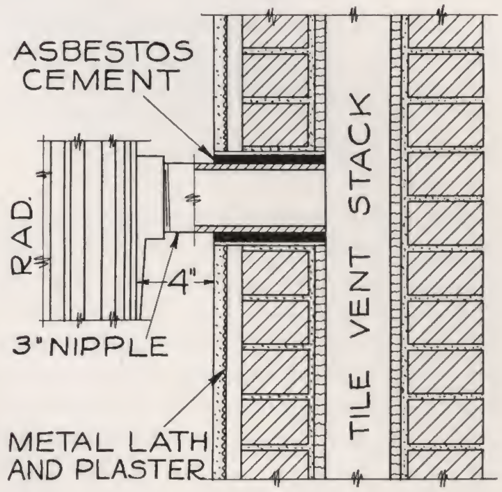


Round iron pipe stacks in concrete partition wall. Joints are bronze welded
Section of concrete partition wall at radiator connection. Note welded cap at bottom of stack to form drip

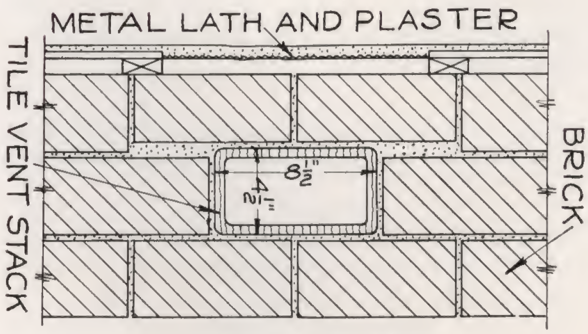
Other types of ventilators which may be used with vent stacks

CLOW GASTEAM RADIATION WITH TILE STACKS

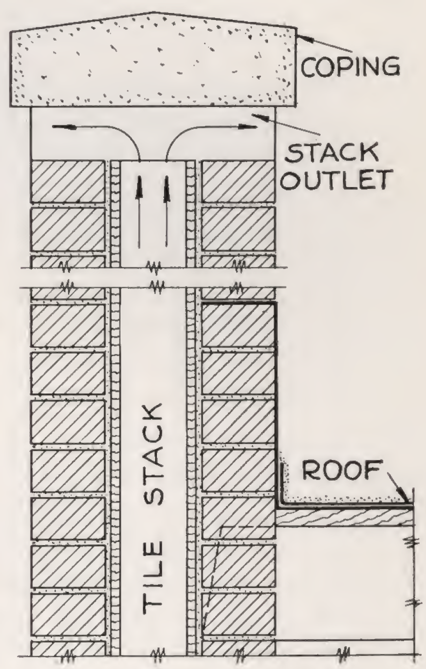
Vents were installed in this building according to details shown on this page.



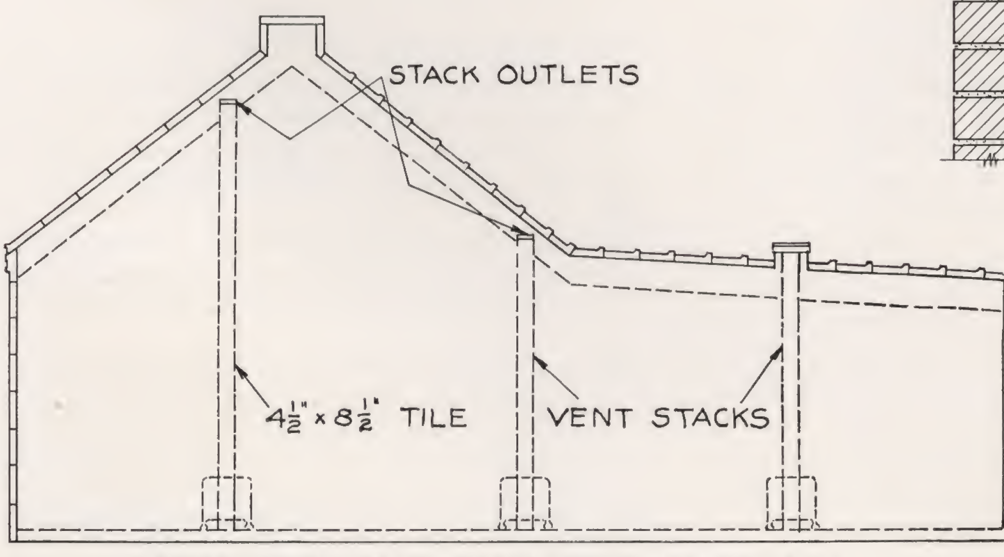
Vent pipe entering wall.



Plan of wall at vent stack



Above is shown method of providing outlet for tiled lined vent stack in parapet wall. The opening extends through the wall, necessary to prevent down drafts in the stack. Opening is made by leaving out brick through each course in the wall. Same method is illustrated at left, except that parapet is pitched, and not horizontal as above.



Elevation of side wall, showing stacks and outlets above roof line.

SPECIFICATIONS

For Stack Spaces for the Installation of Clow "Ventum" Cast Iron Stack Pipe

In Connection with Clow Gasteam Heating

We realize that it is not practical to provide any standard specifications which will meet with the requirements of particular installations. With the assistance of M. R. E. Gilmore M. E. of Schmidt, Garden, and Erikson, widely known Chicago architects, we have carefully prepared specifications which include the fundamental points for the installation of stacks in various types of buildings. On the following pages we have also illustrated actual installations which show approved methods of connecting radiators to stacks (Pages 16 and 17), passing stacks through ceilings, exhausting stacks through roof, or through outside walls (Page 16). Our local representative will be glad to furnish any details relative to all kinds of installations.

1. Where shown on plans a stack space shall be provided in the wall as it is built, to be not less than 4 inches by 8 inches.
2. In a 8½ or 13-inch brick wall, this flue space shall be made by omitting brick on inside of wall forming chase as indicated in sketch on page 14. In frame buildings the space shall be provided by the use of not less than 2 by 4-inch studs, which, with ordinary spacing, will furnish adequate space for installation of stack and for insulating material
3. The stack space shall run as nearly vertical as possible to points indicated on plans.
4. In frame construction, the stack space shall be lined with ⅜-inch gypsum board or air cell or equivalent fire resisting material using no nails through board on back of stack space except at top and bottom or, after stack pipe has been installed, stack space shall be filled from top to bottom with a gypsum noninflammable material, such as Insulex, etc.
5. After the "Ventum" stack pipe has been installed, outside of stack space, to which plaster is to be applied, shall be covered with metal lath in accordance with approved practice, and plaster shall be applied according to contract.
6. In applying plaster and lath leave a ½-inch space around vent tee outlet, or provide a special sheet iron collar to allow the finished C. I. collar to be applied.

For the Installation of Clow "Ventum" Stack Pipe

1. Clow "Ventum" cast iron stack pipe shall be installed in all stack spaces shown on plans before lath and plaster work are started. Not more than two Clow Gasteam radiators shall be connected to one vent stack.
2. A drip tee shall be placed with the center of outlet 22 inches from finished floor line for 26-inch radiators and 27¾ inches for 38-inch radiators and bottom of tee shall be securely capped, either by use of iron cap securely caulked or by running pipe to floor and filling bottom of pipe with 4 inches of concrete. Stack, etc., shall be firmly supported either by floor or studding, so as to bear the weight of stack pipe.
3. "Ventum" pipe shall be installed in accordance with plans, rigidly braced, secured, and all joints securely caulked with lead wool and wicking or with oakum and lead.
4. Outlet of stack pipe shall be constructed as follows:
   (a) If through roof: by sheet metal flashings as shown on page 16.
   (b) If through wall: sleeve as shown and pack with asbestos or mineral wool.
5. The stack shall extend 10 inches above roof to top of stack ventilator.
6. A "Ventum" oval to round pipe fitting shall be installed below roof.
7. Flash around stack and roof with storm tight sheet metal flashing arranged to overlap and to allow for any expansion movement. The roof ventilator shall be of a standard design similar to "Star," "Globe," "Royal," "Aelous," etc.
8. The radiator shall be connected to stack pipe by using a "Ventum" offset nipple threaded to connect to stack outlet of radiator.
9. End of nipple shall be slipped into hub end of stack tee and carefully caulked in place with stove cement or other approved material as shown on page 14.
10. The radiator, when installed, shall stand not less than 4 inches from finished wall.

SPECIFICATIONS

For the Installation of Tile Vent Stacks

In Connection with Clow Gasteam Heating

Note No. 1. No tile stack shall be constructed in frame, stucco-frame, or brick veneer walls unless stacks are encased in 4 inches of brick work.

Note No. 2. No vent stacks should be provided in brick walls by merely omitting a course, or courses of brick, without providing for a fire clay tile stack lining at least ⅝ inches thick.

1. As shown on plans, a tile stack and chase or recess must be provided. The minimum inside area of stack shall be not less than 10 square inches.

2. On 13-inch brick wall omit center brick chase as indicated on sketch.

3. Chase or recess for stack shall be built as nearly vertical as practical to secure the best draft.

4. All stack walls shall be constructed with brick laid flatwise with broken and bonded joints.

5. The stack tile sections shall be wet and set with joints laid in rich sand lime mortar tempered with cement and all voids between masonry and linings shall be filled with mortar.

6. All stack tile shall be erected so that the walls are airtight.

7. Where stacks change direction, the abutting tile at the angle joints be clipped or ground to fit closely, and at no point shall the cross-section be reduced. No broken stack tile shall be used.

8. All stack tile shall be made of approved fire-clay manufactured from suitable refractory clay, designed to withstand high temperatures, of not less than ⅝ inch thickness. All fire-clay stack tiles shall be Clay Products Association standards.

9. *All stacks shall extend not less than 20 inches above the finished roof top of stack ventilator.

10. Flash around connection between stack and roof with storm tight sheet-metal flashing arranged to overlap and to allow for any expansion movement.

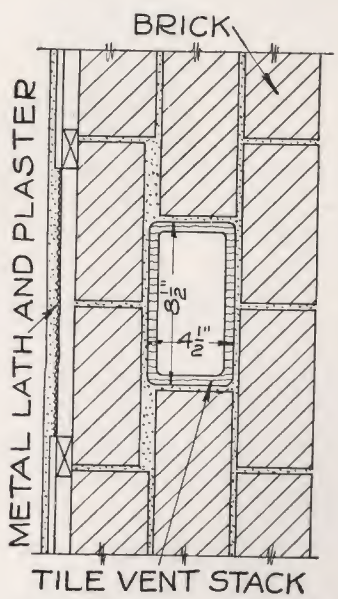
11. All stacks shall be rigidly supported upon concrete or masonry foundations proportioned to carry the weight imposed without danger of settlement or cracking. The bottom of the stack shall be at least 14 inches below the center line of the horizontal radiator vent, and base of stack shall be closed by the use of 4 inches of concrete.

12. After stack is completed it shall be thoroughly cleaned and left smooth on the inside.

13. The top of the stack shall be capped for using a metal connection between the tile and metal roof ventilator. This roof ventilator shall be of a standard design similar to "Star," "Globe," "Aeolus," "Royal," etc,

14. The radiator shall be connected to the stack by using a 3-inch standard nipple threaded to connect to stack outlet of radiator so that it will set 4 inches from finished wall. The other end of nipple shall be slipped into circular vent hole provided for in the tile as shown on page 17, and the nipple shall project into the stack flush with the inside surface of the tile. The connection at the stack shall be carefully sealed with ½-inch of plastic asbestos.

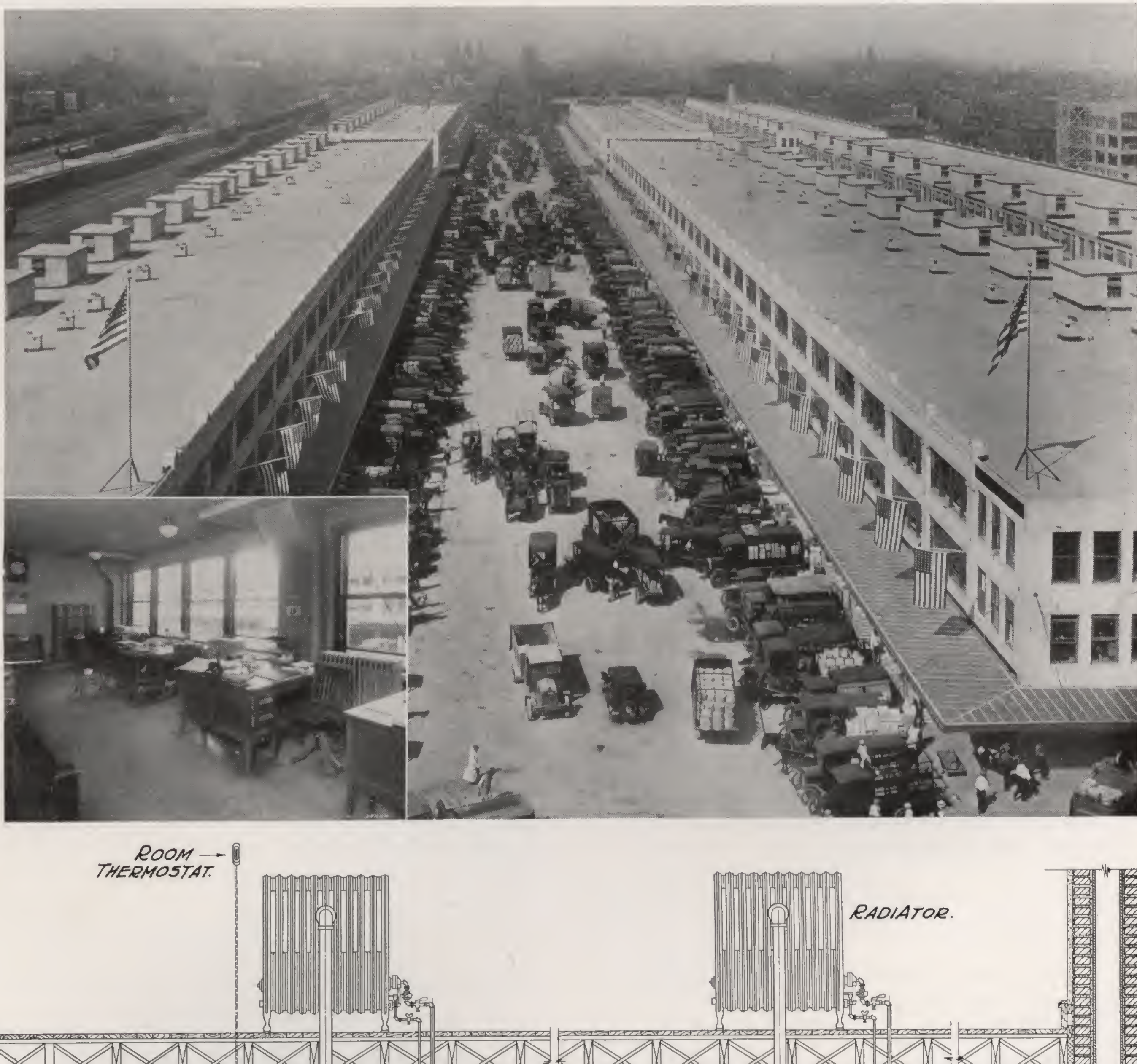
15. The inside wall over the tile stack shall be faced with metal laths lapped at least 6 inches over (adjoining masonry and secured by galvanized staples or anchor nails). Plaster shall be applied over the lath as shown on page 17.

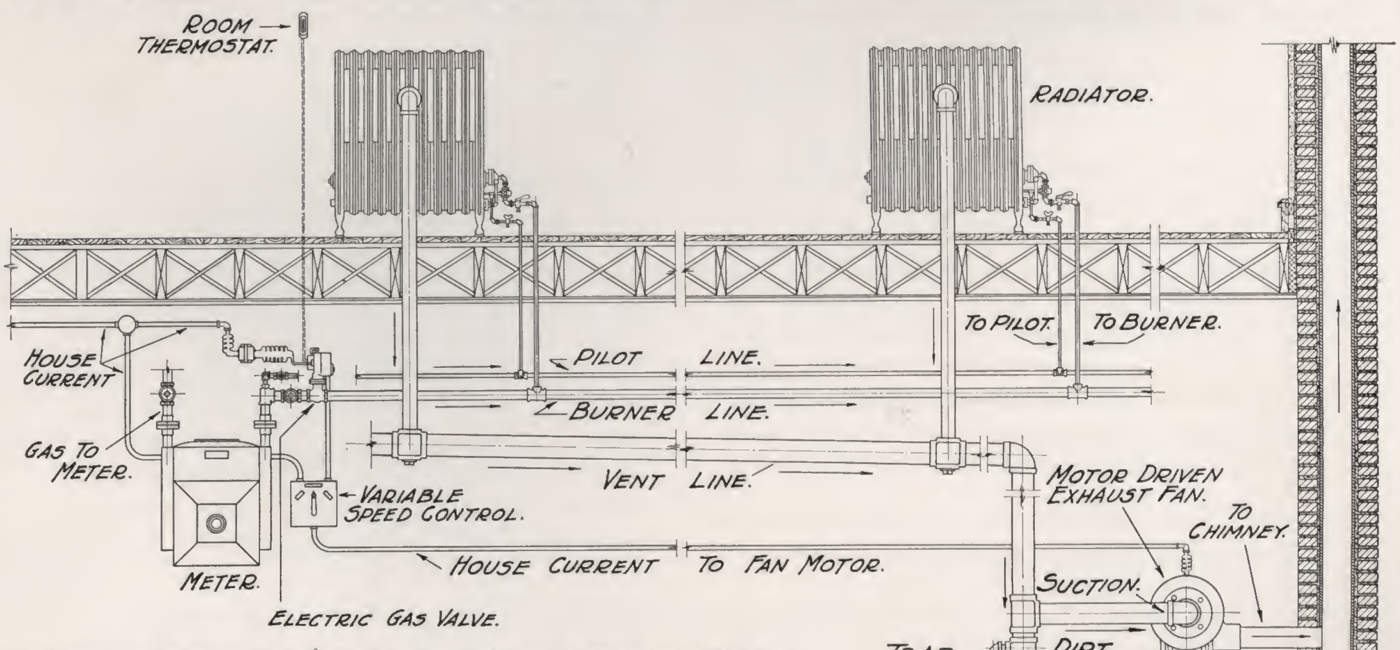


Plan of Brick Wall showing Tile Vent Stack

* For method of handling stacks without going through roof, see page 17.

SOUTH WATER MARKET CHICAGO—CLOW GASTEAM HEATED WITH FAN DRAFT VENTS





Diagrammatic scheme of a typical mechanical draft system controlled by room thermostat. The Gasteam radiators are placed against various convenient walls, and a vent pipe is run down through the floor where it connects into a main vent line or manifold.

MECHANICAL VENT SYSTEMS FOR CLOW GASTEAM RADIATORS

EXPLANATION:

In buildings having only one or no chimney, and where a number of vented radiators are to be installed, a mechanical system of venting can be used very successfully. Ordinarily a radiator will not vent completely on natural draft where there is a horizontal vent pipe 12 feet or longer to the chimney. The solution is the use of a forced draft produced by an exhaust fan.

The use of a fan with a variable speed motor and speed regulator is recommended. A speed regulator guards against excessive draft when only a portion of the system is required. The heat loss in a mechanically vented system of radiators ordinarily is no greater than with natural draft.

DESCRIPTION:

As shown in drawing on page 20, a pipe extends from the vent outlet of each radiator and is connected into a main vent line, which may be located around the wall behind the radiators, over head, or below the floor. The neatest appearing installation is one in which the vent pipes extend from the vent outlets of the radiators down through the floor and are connected into the main vent line. All piping is then out of sight. There may be several radiators connected into one main vent line, leading to the fan. The fan draws the products of combustion from all the radiators through the piping system and exhausts them into a chimney. (If no chimney is available the products of combustion may be exhausted through the wall to the outside air.)

GENERAL RULES:

Main Vent Line Under Floor:

Where vents extend downward all piping must grade toward a condensation drain located immediately ahead of the fan (pitch 1 inch to 20 feet). To provide for the condensation drain, a tee must be connected into the main vent line about 18 inches from the fan intake, with the side outlet facing down to provide a drain connection as described later. This tee should be at the low point in the line. The fan should be installed on a platform close to the chimney or exhaust outlet and elevated at least 4 inches above the main vent line. Connect the main vent line to the fan intake using a series of 45° or long radius ells.

By following the above instructions, the low point in the main vent line will be at the condensation drain connection. Connect to the tee outlet which faces downward a trap which will give at least a 4 inch water seal to prevent air being drawn into the system by the fan through the drain pipe. Continue with at least a ¾ inch pipe from the trap to a convenient drain.

Main Vent Line Located On Wall:

If the vent line is to be located on the walls, behind and below the center line of the radiator vent openings, it should be graded towards the condensation drain.

Main Vent Line Located Above the Center Line of the Radiator Vent Openings:

When the main vent line is located above the radiators, a drain must be provided at the bottom of each vent extending from individual radiators to the main vent line. These drains may be connected together, with a trap ahead of the outlet.

Connecting Vents to the Radiators:

Union or long screw connections must be used in the vent pipe to each radiator in order to allow for the removal of any radiator if necessary. All vent pipes must be free from traps other than those provided to carry off condensation. Where 90° or 45° turns are necessary, the use of long radius fittings is recommended. All piping must be free from burrs and other obstructions.

Preventing Fire Hazard When Installing Vent Lines Through Floors and Walls:

The recommendations of the National Board of Fire Underwriters for the installation of steam pipes should be followed when installing vents for fan systems. It is required that the piping be at least one inch from wood work. Where vent pipes pass through combustible walls, floors or ceilings, they must be encased in metal sleeves one inch larger in diameter than the outside diameters of the vent pipes.

TABLE I

Volume of Products of Combustion for Different Sizes of Vented Clow Gasteam Radiators

4 Column, 38" Vented

Number of Sections	Maximum Gas Consumption in Cu. Ft. per Hr.		Maximum Gas Consumption in B.T.U. per Hr.	Volume of Products of Combustion in Cu. Ft. per Hr.	
	M'f'd Gas 530 B.T.U.	NaturalGas 1000B.T.U.		M'f'd Gas 530 B.T.U.	NaturalGas 1000B.T.U.
5	25	13	13,250	375	390
7	30	16	15,900	450	480
9	35	19	18,550	525	570
11	44	23	23,320	660	690
13	50	27	26,500	750	810
15-20-25	60	32	31,800	900	960

4 Column, 26" Vented

Number of Sections	Maximum Gas Consumption in Cu. Ft. per Hr.		Maximum Gas Consumption in B.T.U. per Hr.	Volume of Products of Combustion in Cu. Ft. per Hr.	
	M'f'd Gas 530 B.T.U.	NaturalGas 1000B.T.U.		M'f'd Gas 530 B.T.U.	NaturalGas 1000B.T.U.
5	15	8	7,950	225	240
7	21	11	11,120	315	330
9	27	14	14,300	400	420
11	33	18	17,500	500	540
13	39	21	20,680	585	630
15-20-25	45	24	23,840	675	720

TABLE II

Drop in Pressure in Inches of Water Column per Foot of Pipe of Various Sizes When Carrying Various Volumes of Products of Combustion per Hour

Volume of Products of Combustion per Hour in c. f.	DIAMETER OF PIPE IN INCHES										
	¾	1	1¼	1½	2	2½	3	3½	4	5	6
225	.1124	.0214	.0059	.0021							
315	.2200	.0420	.0116	.0041							
375	.3122	.0595	.0165	.0058	.0012						
400	.3546	.0676	.0187	.0066	.0014						
450	.4480	.0857	.0238	.0084	.0017						
500	.5520	.1056	.0294	.0104	.0021						
525	.6072	.1166	.0324	.0114	.0022						
585	.7540	.1445	.0403	.0142	.0027						
660	.9576	.1593	.0442	.0156	.0031						
675	.9959	.1666	.0462	.0162	.0032						
750	1.2300	.2379	.0660	.0233	.0046						
900	1.7980	.3426	.0951	.0336	.0066	.0019	.0007				
1000			.1174	.0413	.0082	.0023	.0009				
1100				.0501	.0099	.0028	.0010				
1200				.0596	.0117	.0034	.0012				
1300				.0700	.0137	.0040	.0015				
1400				.0812	.0160	.0046	.0017				
1500				.0932	.0183	.0053	.0019	.0008			
1600				.1062	.0208	.0060	.0022	.0009			
1700				.1197	.0235	.0068	.0025	.0011			
1800				.1344	.0264	.0077	.0028	.0012			
1900					.0293	.0084	.0031	.0013			
2000					.0326	.0094	.0035	.0015			
2100					.0359	.0103	.0038	.0016	.0008		
2200					.0394	.0113	.0042	.0018	.0009		
2300					.0430	.0124	.0046	.0020	.0010		
2400					.0468	.0135	.0050	.0021	.0011		
2500					.0508	.0146	.0054	.0023	.0011		
2600					.0550	.0158	.0058	.0025	.0012		
2700					.0595	.0173	.0063	.0027	.0013		
2800					.0638	.0184	.0068	.0028	.0014		
2900					.0684	.0197	.0073	.0031	.0015		
3000					.0732	.0211	.0078	.0033	.0016		
3100					.0780	.0225	.0083	.0036	.0018		
3200					.0833	.0239	.0088	.0038	.0019		
3300					.0885	.0255	.0094	.0040	.0020		
3400					.0942	.0270	.0100	.0043	.0021		
3500					.0997	.0287	.0106	.0045	.0022		
3600					.1056	.0308	.0112	.0048	.0024		
3700						.0321	.0118	.0051	.0025		
3800						.0338	.0125	.0054	.0026		
3900						.0357	.0132	.0056	.0028	.0008	
4000						.0375	.0138	.0059	.0029	.0009	
4100						.0394	.0146	.0062	.0031	.0009	
4200						.0413	.0153	.0065	.0032	.0010	
4300						.0433	.0160	.0068	.0034	.0010	
4400						.0453	.0167	.0072	.0035	.0011	
4500						.0475	.0175	.0075	.0037	.0011	
4600						.0497	.0183	.0079	.0039	.0012	
4700						.0517	.0191	.0082	.0040	.0012	
4800						.0539	.0199	.0085	.0042	.0013	
4900						.0562	.0208	.0089	.0044	.0013	
5000						.0586	.0216	.0093	.0046	.0014	
5100						.0610	.0224	.0097	.0048	.0014	
5200						.0633	.0233	.0100	.0050	.0015	
5300						.0658	.0243	.0104	.0051	.0015	
5400						.0684	.0252	.0108	.0053	.0016	
5500						.0711	.0262	.0112	.0055	.0017	
5600						.0737	.0271	.0116	.0057	.0017	
5700						.0763	.0281	.0121	.0059	.0018	
5800						.0790	.0291	.0125	.0061	.0019	
5900						.0817	.0301	.0129	.0063	.0019	
6000						.0846	.0312	.0134	.0066	.0020	
6100						.0874	.0322	.0138	.0068	.0020	
6200						.0903	.0332	.0143	.0070	.0021	
6300						.0932	.0343	.0147	.0072	.0022	.0008
6400						.0961	.0354	.0152	.0074	.0022	.0008
6500						.0991	.0365	.0157	.0077	.0023	.0009
6600						.1022	.0377	.0162	.0079	.0024	.0009
6700							.0388	.0166	.0082	.0025	.0009
6800							.0399	.0171	.0084	.0025	.0010
6900							.0411	.0176	.0087	.0026	.0010
7000							.0423	.0181	.0089	.0027	.0010
7100							.0435	.0187	.0092	.0028	.0010

Residence in Beverly Hills, Calif., heated with Clow Gasteam

Residence in Louisville, Ky., heated with Clow Gasteam

Residence in Clearwater, Fla., heated with Clow Gasteam

Residence in New York, N.Y., heated with Clow Gasteam

Residence in Shreveport, La. heated with Clow Gasteam

FOR RESIDENCES Clow Gasteam makes it possible to combine all the comforts of gas fuel with correct steam heating—economically. With Clow Gasteam a home owner can have heat in one room or in every room—with no loss of efficiency. Seasonal heating requirements as well as his own particular living habits are met perfectly with Clow Gasteam.

—And None Too Small

able, healthful steam heat, when and where it is wanted—no more. One radiator is as easily operated as a thousand —and as efficiently— meeting perfectly the heating needs of any building, at any time.

Clow Gasteam radiators handle dry Texas weather just as efficiently as they perform in Illinois or Massachusetts.

Architects, gas men, heating contractors everywhere are specifying and installing Clow Gasteam more and more. Why not make the most of the possibilities Clow Gasteam has for you?

Distributing Offices Listed on page 44

A. G. A.
Approved and Underwriters' Laboratories Listed

CLOW GASTEAM

STOCKED IN EVERY SECTION OF THE COUNTRY

First Methodist Episcopal Church, Pasadena, Calif., heated with Clow Gasteam

Cathedral of St. Augustine (oldest church in the United States), St. Augustine, Fla., heated with Clow Gasteam

St. Paul's Lutheran Church, Coney Island, N. Y. heated with Clow Gasteam

Randolph St. Baptist Church, Charleston, W. Va., heated with Clow Gasteam

FOR CHURCHES all over the United States Clow Gasteam has solved many a heating problem, as no other heating system could. Seldom are all the rooms in a church used at one time. Clow Gasteam makes it possible to heat a church auditorium without wasting heat in the other rooms. A pastor's study, a community room can be made comfortably warm—quickly—without starting up the whole heating system.

TABLE II—Continued

Volume of Products of Combustion per Hour in c. f.	DIAMETER OF PIPE IN INCHES										
							3	3½	4	5	6
7200							.0448	.0192	.0094	.0028	.0011
7300							.0460	.0197	.0097	.0029	.0011
7400							.0473	.0203	.0099	.0030	.0011
7500							.0487	.0208	.0102	.0031	.0012
7600							.0499	.0213	.0105	.0032	.0012
7700							.0513	.0220	.0108	.0033	.0012
7800							.0526	.0226	.0111	.0033	.0013
7900							.0539	.0231	.0113	.0034	.0013
8000							.0553	.0237	.0116	.0035	.0013
8100							.0567	.0243	.0119	.0036	.0014
8200							.0581	.0249	.0122	.0037	.0014
8300							.0595	.0255	.0125	.0038	.0014
8400							.0610	.0261	.0128	.0039	.0015
8500							.0624	.0267	.0131	.0040	.0015
8600							.0639	.0273	.0135	.0041	.0015
8700							.0654	.0280	.0138	.0042	.0016
8800							.0669	.0287	.0141	.0043	.0016
8900							.0684	.0293	.0144	.0044	.0016
9000							.0699	.0300	.0147	.0044	.0017
9100							.0714	.0307	.0150	.0045	.0017
9200							.0731	.0314	.0154	.0046	.0017
9300							.0748	.0321	.0157	.0047	.0018
9400							.0764	.0327	.0161	.0048	.0018
9500							.0779	.0334	.0164	.0050	.0019
9600							.0796	.0341	.0167	.0051	.0019
9700							.0813	.0348	.0171	.0052	.0019
9800							.0829	.0355	.0174	.0053	.0020
9900							.0847	.0363	.0178	.0054	.0020
10000							.0863	.0370	.0182	.0055	.0021
10100							.0880	.0378	.0186	.0056	.0021
10200							.0899	.0385	.0189	.0057	.0021
10300							.0916	.0392	.0193	.0058	.0022
10400							.0934	.0400	.0196	.0059	.0022
10500							.0951	.0407	.0200	.0061	.0023
10600							.0970	.0415	.0204	.0062	.0023
10700							.0986	.0422	.0208	.0063	.0024
10800							.1008	.0432	.0212	.0064	.0024
10900								.0439	.0216	.0065	.0024
11000								.0447	.0219	.0066	.0025
11100								.0455	.0223	.0068	.0025
11200								.0464	.0228	.0069	.0026
11300								.0472	.0232	.0070	.0026
11400								.0480	.0236	.0071	.0027
11500								.0488	.0240	.0073	.0027
11600								.0498	.0244	.0074	.0028
11700								.0506	.0248	.0075	.0028
11800								.0514	.0252	.0076	.0029
11900								.0524	.0257	.0078	.0029
12000								.0532	.0261	.0079	.0030
12100								.0540	.0266	.0080	.0030
12200								.0550	.0270	.0082	.0031
12300								.0558	.0274	.0083	.0031
12400								.0568	.0279	.0084	.0032
12500								.0577	.0283	.0086	.0032
12600								.0587	.0288	.0087	.0033
12700								.0596	.0293	.0088	.0033
12800								.0606	.0298	.0090	.0034
12900								.0616	.0302	.0091	.0034
13000								.0625	.0307	.0093	.0035
13100								.0635	.0312	.0094	.0035
13200								.0644	.0316	.0096	.0036
13300								.0653	.0321	.0097	.0036
13400								.0664	.0326	.0098	.0037
13500								.0674	.0331	.0100	.0038
13600								.0685	.0336	.0101	.0038
13700								.0694	.0340	.0103	.0039
13800								.0704	.0346	.0104	.0039
13900								.0715	.0351	.0106	.0040
14000								.0724	.0356	.0108	.0040
14100								.0735	.0361	.0109	.0041
14200								.0746	.0366	.0111	.0041
14300								.0755	.0371	.0112	.0042
14400								.0766	.0376	.0114	.0043
14500								.0777	.0381	.0115	.0043
14600								.0788	.0387	.0117	.0044
14700								.0800	.0392	.0119	.0044
14800								.0810	.0397	.0120	.0045

TABLE II—Continued

Volume of Products of Combustion per Hour in c. f.	DIAMETER OF PIPE IN INCHES									
								3½	4	5	6
14900								.0822	.0403	.0122	.0046
15000								.0832	.0408	.0124	.0046
15100								.0843	.0414	.0125	.0047
15200								.0854	.0419	.0127	.0048
15300								.0864	.0425	.0128	.0048
15400								.0875	.0430	.0130	.0049
15500								.0888	.0436	.0132	.0049
15600								.0900	.0442	.0134	.0050
15700								.0911	.0447	.0135	.0051
15800								.0923	.0453	.0137	.0051
15900								.0936	.0459	.0139	.0052
16000								.0949	.0465	.0141	.0053
16100								.0960	.0471	.0142	.0053
16200								.0972	.0477	.0144	.0054
16300								.0984	.0482	.0146	.0055
16400								.0995	.0488	.0148	.0055
16500								.1007	.0494	.0150	.0056
16600									.0500	.0151	.0057
16700									.0507	.0153	.0057
16800									.0513	.0155	.0058
16900									.0519	.0157	.0059
17000									.0525	.0159	.0059
17100									.0532	.0161	.0060
17200									.0538	.0163	.0061
17300									.0544	.0164	.0062
17400									.0551	.0166	.0062
17500									.0557	.0168	.0063
17600									.0563	.0170	.0064
17700									.0570	.0172	.0065
17800									.0576	.0174	.0065
17900									.0583	.0176	.0066
18000									.0589	.0178	.0067

TABLE III

Showing Length of Straight Pipe Equivalent to One Standard Elbow

Diameter in Inches	Equivalent Length in Feet
1	1.7
1¼	2.6
1½	3.3
2	5.1
2½	6.7
3	9.3
3½	11.5
4	14.0
4½	18.0

45° ells are estimated to have 20% less resistance than 90° ells.

Method of Calculating Gasteam Radiator Vent Pipe Sizes for Mechanical Draft Systems:

1. Draw a plan of the proposed layout to scale. The pipe into which the vents from the several radiators connect is designated as the "main vent line".

2. Designate the radiator nearest to the fan as radiator No. 1, and the point at which it connects to the main vent line as A. The radiator next nearest to the fan is radiator No. 2 and the point at which it connects to the main vent line is B. Continue in this order until all the radiators and junction points are numbered and lettered.

The main vent line should be referred to by sections. That portion between the points where radiators No. 1 and No. 2 connect to the main vent line should be referred to as section (A-B). Similarly the section between the points where radiators No. 2 and No. 3 connect to the main vent line is referred to as section (B-C). Continue in this manner until all the sections are identified.

The main vent line should be considered as beginning at the outlet of the radiator farthest from the fan and ending at the fan.

Where possible only one size pipe will be used in each section of the main vent line.

3. Design the main vent line for approximately 1.5 inches water column drop in pressure between the fan and the radiator farthest from it. Experience has shown that a drop in pressure less than 2 inches water column gives the best results. The lower the pressure drop, the lower the speed at which the fan need be operated, and consequently the less vibration.

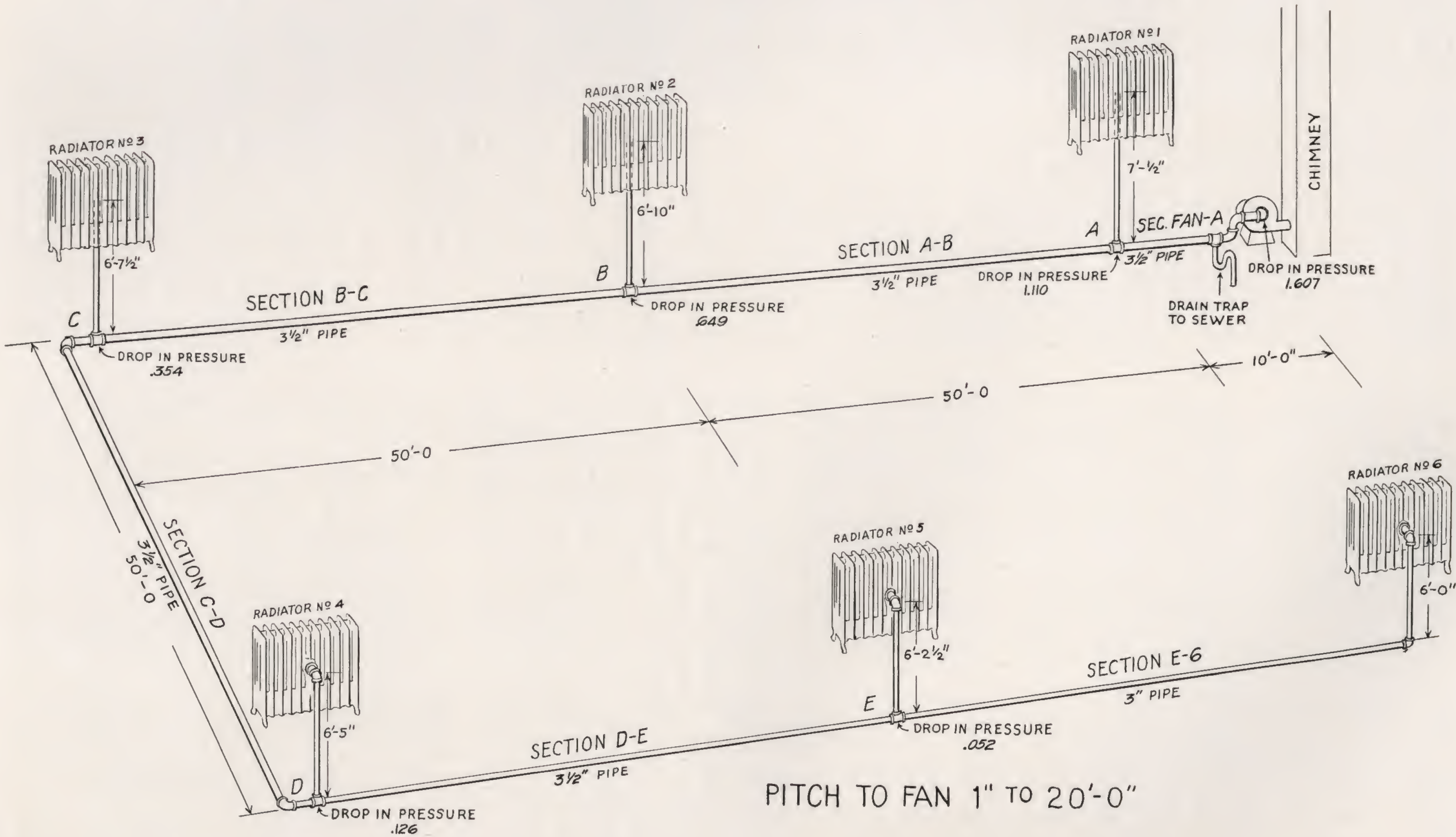
The form used in the example on page 27 should be used for tabulating results. Following is a discussion of the various headings of this form.

(a) Section:

Under this heading, list the various sections of the main vent line in their order starting with section (Fan-A) which is that portion between the fan and the point where the connection from radiator No. 1 joins the main vent line. Next list section (A-B) which is that portion between the points where radia-

(Continued on page 26)

DETAIL OF MECHANICAL VENT SYSTEM



PITCH TO FAN 1" TO 20'-0"

Method of Calculating Gasteam Radiator Vent Pipe Sizes for Mechanical Draft Systems:

(Continued from page 24)

tors No. 1 and No. 2 join the main vent line. Continue in this manner until all sections of the main vent line are listed. Remember that the main vent line extends to the vent opening in the radiator farthest from the fan.

(b) Volume:

List the volume in cubic feet per hour of the products of combustion which is to be carried by each section of the main vent line. See Table I. For instance, in a system of 6 radiators, section (E-6) carries the products of combustion from radiator No. 6 only, section (D-E) carries the products of combustion from radiators No. 5 and No. 6, and section (C-D) carries the products of combustion from radiators No. 4, No. 5 and No. 6, and so on.

(c) Actual Length:

List the measured length of each section of the main vent line.

(d) Pipe Size:

To ascertain the size of pipe suitable for the various sections of the main vent line,

1. Divide the allowable pressure drop over the main vent line (1.5 inches) by the total length of the main vent line in feet.

2. Find from Table II the size of pipe suitable for each section by means of the average drop per foot and the volume of products of combustion in cubic feet per hour to be carried by each section. To do this, select in the column headed "Volume of Products of Combustion in Cubic Feet Per Hour" in Table II the figure nearest to the volume to be handled by the section of the main vent line which is being considered. Then follow to the right to the column containing the pressure drop per foot nearest the approximate pressure drop per foot calculated as described in paragraph 1 above. At the top of this column the suitable pipe size is shown.

(e) Equivalent Length:

List the equivalent length of each section of the main vent line. The equivalent length is the actual length plus the length of pipe to which the fittings are equivalent. The straight pipe equivalents of standard elbows are given in Table III. Tees in the main vent line are figured as elbows of the same size as the main vent line and are figured in the section which is on the side of the tee towards the fan.

(f) Pressure Drop Per Foot:

List the pressure drop per foot of the pipe size chosen for each section of the main vent line when carrying the required volume of products of combustion. These pressure drops were determined in selecting pipe sizes under (d).

(g) Pressure Drop Per Section:

Calculate and list the drop in pressure for each section of the main vent line. This pressure drop is obtained by multiplying "Equivalent Length" by "Pressure Drop Per Foot".

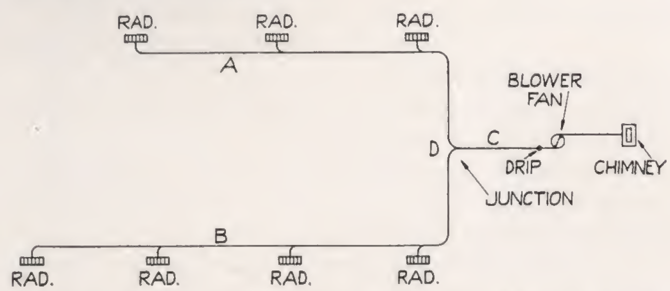
Total the pressure drops for all sections. This total drop in pressure through the main vent line should be approximately 1.5 inches. If the total drop in pressure is more than 2 inches, increase the pipe size in enough sections of the main vent line to bring the total pressure drop between 1.5 inches and 2 inches.

(h) Pressure Drop in Main Vent Line at Points of Connection of Each Radiator Vent Pipe:

Obtain the drop in pressure at the point of connection of each radiator into the main vent line. This is done by adding the drops in pressure for all the sections between each connection and the radiator farthest from the fan. Thus, if there are 6 radiators on a system, the drop in pressure at point E (see Page 25) is the drop in pressure through section (E-6). The drop in pressure at point D is the drop in pressure through section (D-E) plus the drop in pressure through section (E-6). The drop in pressure at point C is equal to the sum of the drops in pressure through sections (C-D), (D-E) and E-6), and so on.

Method of Procedure When There Are Two Branches of the Main Vent Line

In such cases, calculate the pipe sizes of the longer branch of the main vent line (B in sketch below) and of the connection (C) between the junction point of the two branches (D in sketch below) and the fan, so that the pressure drop through these two sections (B and C) of the main vent line equals approximately 1.5 inches. Calculations must take into account the fact that section C carries the products of combustion from both branches A and B. Obtain the pressure drop through branch B to junction point D. The pipe sizes in section A must be so selected that the pressure drop through branch A equals the pressure drop through branch B.



Method for Calculating the Size of Vent Pipe from Each Radiator to the Main Vent Line

The drop in pressure at each point of connection for the vent pipe from each radiator into the main vent line was determined under paragraph (h). THE VENT PIPE SIZE BETWEEN EACH RADIATOR AND THE MAIN VENT LINE MUST BE SELECTED TO GIVE THE PRESSURE DROP THAT EXISTS IN THE MAIN VENT LINE AT EACH POINT OF CONNECTION. The drop in pres-

sure through the vent connection must equal the pressure drop through the main vent line between the point of connection and the radiator farthest from the fan. This is important for the following reason: If the drop in pressure through the radiator vent pipe is greater than the pressure drop in the main vent line at the point of connection there will not be sufficient draft at this radiator and it will not vent sufficiently. If the pressure drop through the radiator vent pipe is less than the pressure drop in the main vent line at the point of connection there will be too much draft at this radiator and not enough at the other radiators.

The size of vent pipe to be installed between the radiator and the main vent line is calculated as follows: First, calculate the approximate drop in pressure per foot of pipe by dividing the required pressure drop by the length of the vent pipe. By means of Table II and using the approximate pressure drop per foot, select a pipe size, or a combination of pipe sizes which will give the required pressure drop for the equivalent length of the vent connection.

EXAMPLE OF SIZING VENT PIPES:

A 15 section, 4 column, 38" vented radiator is to be connected to the main vent line, and the distance between the point of connection and the vent outlet of the radiator is 6 feet; the drop in pressure at the point of connection in the main vent line is .590 inches.

From Table I it is found that it will be necessary to handle 900 cubic feet of products of combustion per hour from a 15 section, 4 column, 38" vented radiator if manufactured gas is used.

The equivalent length of straight pipe from the radiator to the main vent line is 6 feet plus the length of straight pipe equivalent to the elbow used at the radiator. Use an average of 3 feet for this equivalent for the preliminary calculations.

The approximate pressure drop per foot equals $\frac{.590}{9}$ equals .065 inches. From Table II it is found that .065 inches is between .0951 inches and .0336 inches which are the respective pressure drops per foot of 1¼" and 1½" pipes when carrying 900 cubic feet of products of combustion per hour.

Therefore, the vent must be made up of the correct proportions of 1¼" and 1½" pipe to give an actual drop in pressure of .590 through the vent pipe from the radiator to the connection in the main vent line.

Assume that the 1¼-inch pipe connects into the radiator and the 1½-inch pipe connects into the main vent line. There will be required one 1¼-inch elbow at the radiator, which from Table III is equivalent to 2.6 feet of straight pipe. Therefore, the equivalent length of straight pipe required is 6 feet plus 2.6 feet or 8.6 feet.

By trial and error it is found that the correct proportions of 1¼" and 1"½ pipe are 2.4 feet of 1¼" pipe and 3.6 feet of 1½" pipe, the ell at the radiator being 1¼".

EXAMPLE OF SIZING A MAIN VENT LINE AND RADIATOR VENT CONNECTIONS:

The application of the foregoing data and methods to balancing a mechanical vent system may be more clearly illustrated by showing the method used in calculating an actual installation. This installation consists of six 15 section, 4 column, 38 inch radiators, spaced approximately fifty feet apart.

The total length of main vent line is 266 feet. The distance between vent outlet of radiator No. 6 and the main vent line is 6 feet. The distance between the vent outlet of each following radiator and the main vent line increases at the rate of 1 inch per 20 feet, lineal length of main vent line.

The drop allowed over the main vent line was 1.5 inches.

The length of each section of the main vent line is 50 feet, except section (Fan – A) between points A and the fan which is 10 feet and section (E-6) which is 56 feet. Section (E-6) is 56 feet in length since the main vent line connects directly with the vent outlet of radiator No. 6. The drop in pressure in the main vent line at the point of connection of the vent from each radiator, and also the total allowable drop in pressure over the main vent line was calculated as follows:

SOLUTION:

MAIN VENT LINE SIZES

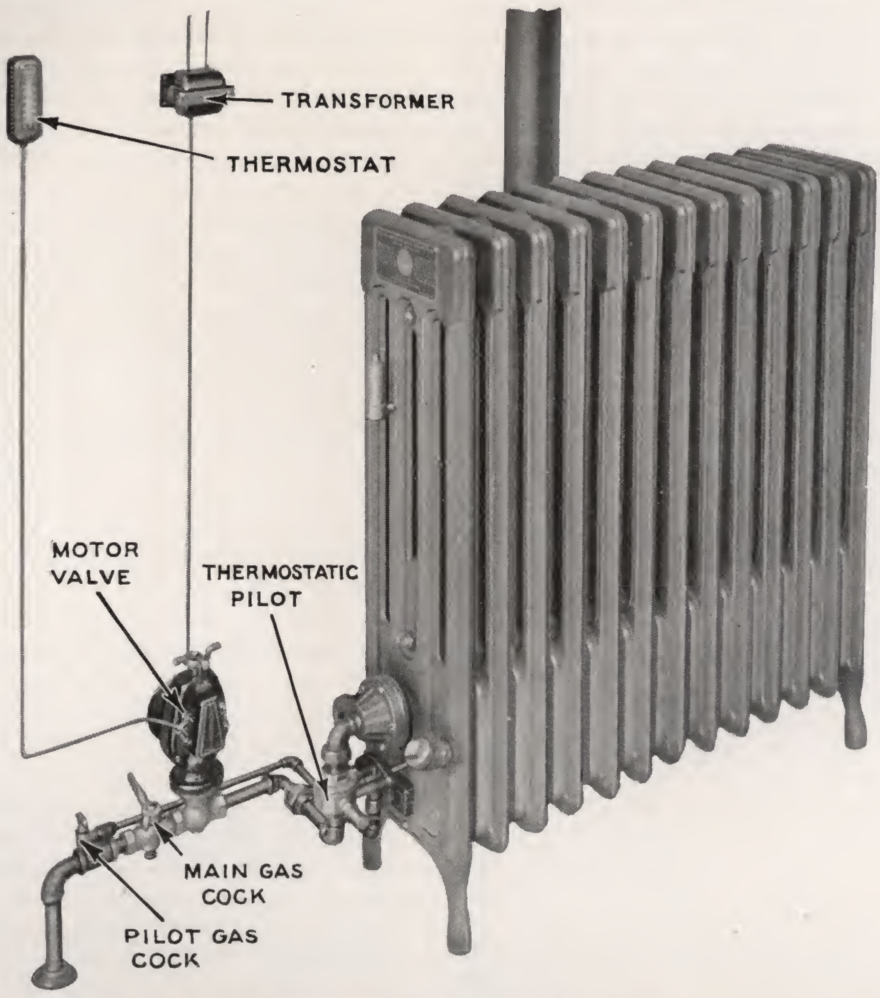
Section	Volume Carried	Actual Length	Pipe Size	Equivalent Length	Press. Drop per Ft.	Press. Drop per Section	Press. Drops in Main at Points of Connection of Each Radiator Vent Pipe	
							Connection Points	Drop
Fan-A	5400	10′	3½″	(4 Ells) 46′	.0108″	.497″	Fan	1.607″
A-B	4500	50′	3½″	(1 Ell) 61.5′	.0075″	.461″	A	1.110″
B-C	3600	50′	3½″	(1 Ell) 61.5′	.0048″	.295″	B	.649″
C-D	2700	50′	3½″	(3 Ells) 84.5′	.0027″	.228″	C	.354″
D-E	1800	50′	3½″	(1 Ell) 61.5′	.0012″	.074″	D	.126″
E-6	900	56′	3″	(2 Ells) 74.6′	.0007″	.052″	E	.052″

RADIATOR VENT PIPE SIZES

Radiator Vent Pipe	Volume Carried	Actual Length of Vent Pipe		Vent Pipe Sizes	Equivalent Length of Vent Pipe	Press. Drop per Ft.	Press. Drop for Vent Pipe	
1-A	900	7′	6.21′	1¼″ at rad.	8.81′	.0951″	.838″	1.110″
			.79′	1″	.79′	.3426″	.272″	
2-B	900	6.8′	1.76′	1½″ at rad.	5.06′	.0336″	.170″	.649″
			5.04′	1¼″	5.04′	.0951″	.479″	
3-C	900	6.6′	6.24′	1½″ at rad.	9.54′	.0336″	.321″	.355″
			.36′	1¼″	.36′	.0951″	.034″	
4-D	900	6.4′	4.55′	2″ at rad.	9.65′	.0066″	.064″	.126″
			1.85′	1½″	1.85′	.0336″	.062″	
5-E	900	6.2′	.32′	2½″ at rad.	7.02′	.0019″	.013″	.052″
			5.88′	2″	5.88′	.0066″	.039″	

E-6 is considered part of main vent line.
Note that lengths of radiator vent pipes increase as the main approaches the fan due to downward pitch of main.

GASTEAM WITH ROOM TEMPERATURE CONTROL



Room Temperature Control with Motor Valve
For Multiple Radiator Installations

There are some conditions where room temperature control with Gasteam radiators is desirable. One of the standard parts of each Clow Gasteam radiator is a steam pressure control which regulates the gas supply to the burner to maintain a constant steam pressure in the radiator. If radiation is installed to maintain a predetermined temperature in an enclosed space when the outside air is at the average extreme low temperature, then during moderate weather the radiation will raise the inside temperature higher than necessary. However, since each Clow Gasteam radiator is an individual heating unit operating independently of others in the same room or building, satisfactory control of room temperatures can be accomplished by operating only part of the radiators during mild weather. Under climatic conditions where heat is required mainly in the mornings and evenings, the gas can be burned in the radiators only long enough to bring the room temperature up to the desired degree and then turned off. The heat contained in the radiator supplies some heat to the room for 30 minutes to one hour after the gas is turned off.

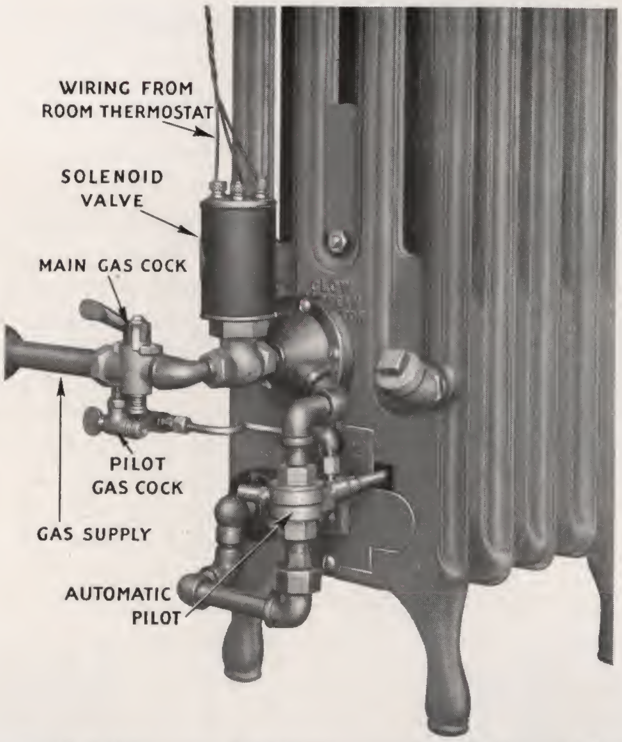
There are conditions where manual control of the radiators is not convenient. Room temperature control can be used to meet such conditions. There are several manufacturers of room temperature regulators that make suitable equipment for use with Clow Gasteam radiators. The illustrations show the application of two types of gas controls operated by a room temperature thermostat and used in connection with a thermostatic pilot.

The solenoid type of gas-cut-off is usually used with one radiator. Where two radiators are to be controlled by one room thermostat a solenoid valve should be used with each radiator.

The motor valve gas-cut-off is generally used where several radiators are to be controlled from one room thermostat. The piping arrangement for this type of installation is shown on page 20. A separate gas line must be provided for the thermostatic pilots.

A thermostatic pilot should be used on each radiator operated by a cut-off valve and room thermostat. Thermostatic pilots are designed to prevent the flow of gas to the main burner when the pilot gas is not burning.

GASTEAM WITH ROOM TEMPERATURE CONTROL



Single radiator room temperature control with Solenoid valve

All Radiators need not be Controlled by the Room Thermostat

All the Gasteam radiators in an installation need not always be controlled by the room temperature control. In fact, experience has shown that only part of the radiators thus controlled gives the most satisfactory results. In the case of a residence installation, best results are obtained by applying room temperature control to only the living room and dining room radiators. Bathroom radiators are generally operated continuously during cold weather, and at night as well as in daytime. Bedroom and kitchen radiators give best results when manually controlled, since they can then be operated in accordance with variable heating demands. Most sleeping rooms require no direct heat except during the extreme cold weather, since most of the time enough heat circulates from the living rooms and hall to keep bedrooms comfortable in moderate weather. The hall radiator is most satisfactory under manual control. In very mild weather the thermostatically controlled radiators in the living rooms alone may be operated. During medium cold weather the hall and bathroom radiators are allowed to burn continually, augmented by the thermostatically controlled living room radiators, which operate only enough to maintain a constant temperature.

When using room temperature control in a school, church, or industrial installation, not more than half of the Gasteam radiators should be controlled by the room thermostat. Radiators should be located alternately manual control and room thermostat control. During mild weather only the thermostatically controlled radiators are used. In colder weather the manually controlled radiators operate continuously during the period when heat is required, although there are not enough of them to meet the entire heat requirements. The thermostatically controlled radiators then supply the additional heat needed. A much more even temperature can be maintained by this arrangement than with a system controlled entirely with a room thermostat. Sharp rises and lowerings of temperature, caused by the lag which accompanies alternately shutting off all heat and then turning on the full capacity, is avoided. When all heat is turned off, and the room temperature falls low enough to cause the room thermostat to send more heat, some time elapses before a system entirely off and cold can respond. During this interval the room temperature has fallen still lower. When the system comes up to full heat, and re-establishes the desired room temperature, the thermostat closes off the gas. But the heat stored up in the heating system, brought to full capacity, in moderate weather carries the room temperature beyond the shutting off point. This saw-tooth temperature range effect is very pronounced with a central hot water heating system due to the relatively large amount of heat contained in the water. It is characteristic in central steam heating, where one room thermostat controls the entire fuel supply to the boiler.

The fact that each Clow Gasteam radiator can be operated independently from all other installed in the system makes possible perfect control of temperature, and allows part of the radiators to operate while others are shut off without loss of efficiency in the system. Closing off part of the radiation on a central heating system unbalances the ratio of heat producing capacity to heat requirements, and thus lowers efficiency. Constant balance between heat generation and heat requirements in a Clow Gasteam system is one reason for its remarkably low operating cost, in comparison with a central heating plant.

GASTEAM COMBINED WITH CENTRAL HEATING

Gasteam Supplying Steam to Ordinary Radiators

Combination Gasteam Heating

Clow Gasteam radiators may be connected to central steam heating systems in place of ordinary radiators. Installed in this way, they may be used as ordinary steam radiators, or they may be operated entirely independent of the central heating system.

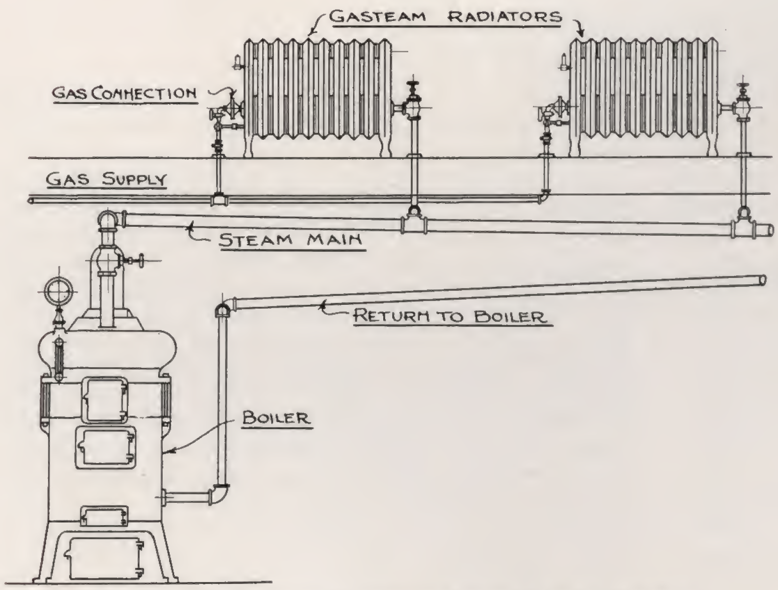
Gasteam radiators when attached to a central heating system, replace the ordinary steam radiators. When the boiler is used the Gasteam radiators function as ordinary radiators. Before the entire heating plant need be started in the fall, and after it is shut down in the spring, the Gasteam radiators alone are used. Merely closing each radiator valve in the main steam pipe line, makes it possible to heat any rooms desired —a few hours, or all day.

A great saving results when the central heating plant need not be operated in mild weather. The convenience, and ease of operation of this system is very apparent.

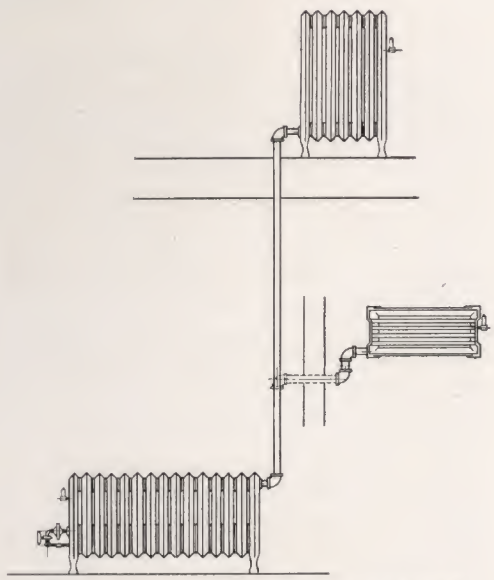
Gasteam Supplying Steam to Ordinary Radiators

In small rooms, such as bath rooms, small offices, closets, and kitchens, ordinary radiators may be connected as illustrated to Clow Gasteam radiators in adjoining rooms. Thus connected, the Gasteam radiator supplies steam for itself and the ordinary radiator, often resulting in floor space economy.

A Clow Gasteam radiator thus connected will maintain 5 pounds steam pressure in both radiators when the square feet of radiation in the ordinary type is not greater than 50% of the Gasteam radiation. No valves should be installed in the steam piping. The entire system operates as a unit.



Illustrating Combination Gasteam—Central Heating System

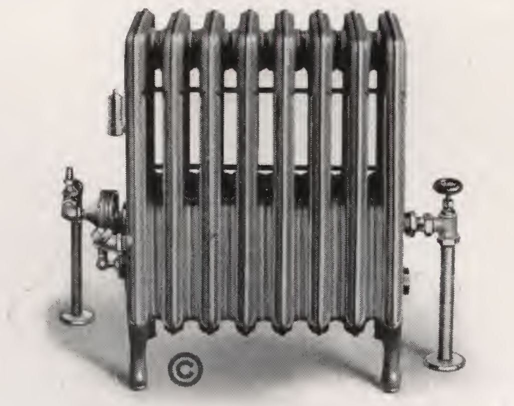

Gasteam Connected to Ordinary Radiators

Equivalent Sq. Ft. of Radiation for Gasteam Radiators When Used as Ordinary Radiators
At 5 Pounds Steam Pressure

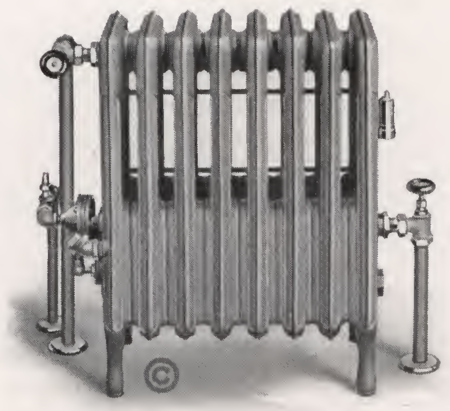
Number of Sections	2	3	4	5	6	7	8	9	10	11	12	13	14	15
38" 4 Column Unvented	......	......	20	......	29	......	37	......	44	......	53	......	......	66
26" 4 Column Unvented	......	......	12	......	16	......	21	......	26	......	31	......	......	38
22" 4 Column Unvented	......	......	9	......	13	......	16	......	20	......	24	......	......	30
38" 4 Column Vented	......	......	......	23	......	32	......	41	......	50	......	59	......	68
26" 4 Column Vented	......	......	......	13	......	18	......	23	......	28	......	33	......	38
31" 6 Column Unvented	15	20	24	29	34	39	43	48	53	......	......	......	......	......

CLOW GASTEAM COMBINED WITH CENTRAL HEATING PLANTS

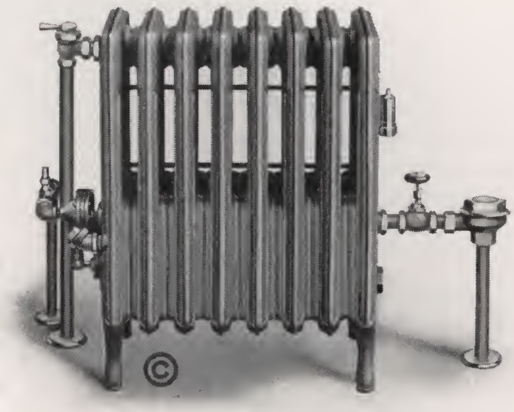
These illustrations show the piping and the placing of valves for Clow Gasteam radiators, when used in combination heating as part of central steam plants. To operate them independently, it is only necessary to turn off the steam valves and light the gas in the Gasteam radiators.



Clow Gasteam Radiator as used in one-pipe system



Clow Gasteam Radiator as used in two-pipe system



Clow Gasteam Radiator as used in vacuum system

Clow Gasteam Radiator connected in combination with a central heating plant

HEATING SCHOOLS WITH CLOW GASTEAM

Clow Gasteam Heating is successfully employed for school heating where the system of ventilation is either by window, by gravity, or by a mechanical system of ventilation indicated in drawing on page 33.

In calculating the amount of radiation required for a school room where any method of ventilation is employed, it is recommended that the radiation required for air change be calculated separately from that required to offset the heat loss from the walls, glass, ceilings, and floors.

The general practice is to allow 30 cu. ft. of outside air per pupil per minute. This would be 1800 cu. ft. per pupil per hour. If radiation is to be sized for 70° F. inside with 0° F. outside then 10 sq. ft. of steam radiation must be installed per pupil to warm the outside air supply. If the heating range is +20° F.to 70 ° F. then the radiation per pupil for outside air supply is 7.1 sq. ft. of steam radiation. This radiation must be installed in addition to the amount calculated to take care of the heat losses for walls, glass, floors and ceilings. If the amount of outside air is specified in air changes per hour, multiply the cubical contents by the number of air changes to obtain the cubic feet of outside air to be supplied per hour. Divide the cubic feet of air required per hour by 180 for a 70° rise, or by 253 for a 50° rise, in order to determine the amount of steam radiation required to warm the outside air supply.

Window Ventilation

Where window ventilation is to be employed, enough radiation must be placed under the windows to take care of the heat required to warm the incoming air plus the heat loss through the glass itself. The rest of the required radiation to heat the school room should be located along exposed walls and at other points where the heat loss is most pronounced.

Mechanical Ventilation

The mechanical system of ventilation (shown on page 33) is an exhaust system. Outside air is drawn into the classroom through grilles in the outside walls and is warmed in passing over the radiators. Air leaves the room by a vertical exhaust duct connected to a fan in a pent house on the roof.

The exhaust fan and pent house which encloses it is located on the roof, or in the attic, and discharges through the roof of the school building. The outlet of the pent house should face to the leeward. The operation of the exhaust fan is controlled from a switch located in the classroom. This switch should have a pilot lamp in the circuit so that the operator can tell when the fan is in operation.

Several well known manufacturers of ventilating equipment make an exhaust fan fitted with individual enclosures. Complete information on sizes and capacities are available in these manufacturers' bulletins.

The correct amount of radiation must be installed in front of the outside air inlets to warm the air sufficiently as it enters.

The size of each outside air inlet should be approximately 200 square inches in area. This will permit the passage of 20,000 to 30,000 cubic feet of air per hour into the class room without having an objectionable velocity. The number of inlets per hour will then be determined by the amount of outside air to be admitted per hour divided by the capacity per inlet. When figuring a 70° rise use the lower capacity figure and when figuring a 50° rise use the high capacity figure. When a gravity ventilating system is employed use the smaller figure as the capacity of the outside air inlet. (See Gravity Ducts below.)

An arrangement of the outside air opening and radiator enclosure connected to it is shown on page 34.

The outlet register, or registers, should be located at the opposite side of the room from the outside air inlets and should open into the room just above the floor line. The capacity of these registers is calculated at 21,000 cubic feet of air per hour per square foot of net area. The outlet ducts can handle 36,000 cubic feet of air per hour per square foot of cross sectional area. An outlet duct may be made large enough to correspond to the capacity of three to four outside air inlets. In no case should an outlet duct serve more than one classroom.

Gravity Ducts

Gravity exhaust ducts may be calculated on the basis of 110 cubic feet of air per hour per square inch of area, providing that an aspirating radiator is used in the base of the exhaust duct. Allow one square foot of radiation (for the aspirating radiator) for 2,800 cubic feet of air to be exhausted per hour for first floor rooms, and for 2,000 cubic feet of air per hour for second floor rooms.

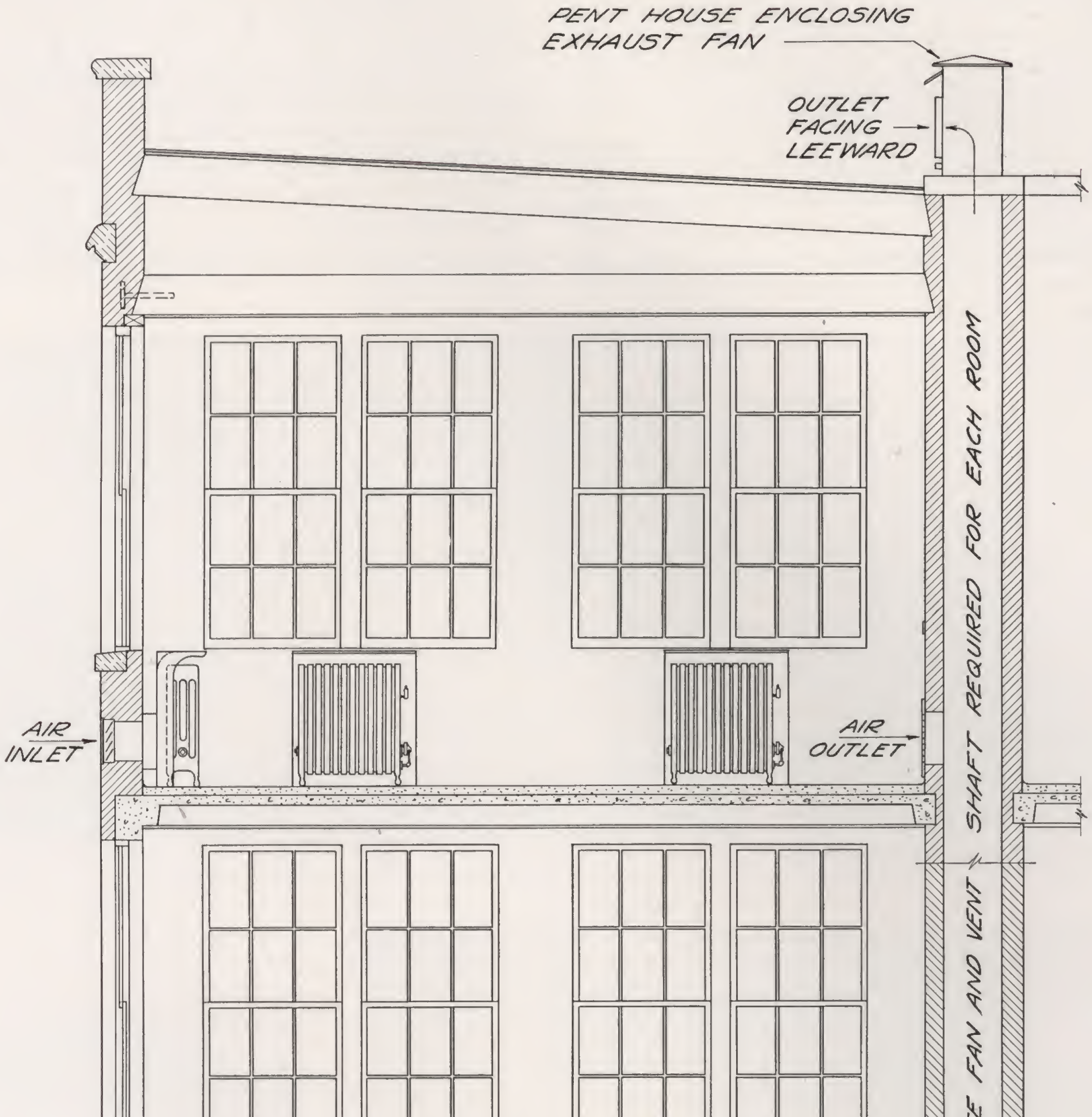
A roof ventilator of suitable capacity must be installed at the top of the exhaust duct.

Advantages in School Heating

Low cost of operation is one of the greatest advantages of Clow Gasteam systems. With either window, gravity, or mechanical ventilation it is possible to supply outside air only to class rooms when occupied. The heat required to warm the outside air is often as much or more than the other heating requirements. By being able to limit this heating requirement to school hours and to individual class rooms that are in use makes the cost of fuel far below any system that depends on air change alone to heat the building or one in which the outside air supply to the whole building comes from one fan which necessitates supplying outside air to all class rooms whether or not they are all in use.

Continued on page 34)

GASTEAM WITH MECHANICAL VENTILATION



Typical arrangement of Gasteam radiators with special Clow ventilating radiator shields, air inlets, and outlets, exhaust ducts, and exhaust fans, located in individual pent houses.

(Continued from page 32)

The individual control of the outside air supply allows radiators normally used to warm the incoming air to be used to help raise the temperature of the building in the mornings before school hours. With this additional radiation available for use before class time the lower night temperatures can be maintained for longer hours which results in pronounced savings.

Clow Gasteam heating systems require no separate furnace room. Each radiator is a complete heating plant in itself and occupies no more space than ordinary steam radiation. Therefore the space ordinarily occupied with a central boiler or furnace is saved. On new building the cost is lowered proportionately. On schools already built the furnace room can be converted into a class room, laboratory or cloak room.

Example:

A 20-pupil second floor school room, 27' long x 15' wide x 12' high, is to be heated from 0° to 70° with Clow Gasteam radiators and ventilated with the mechanical system above described. One 27' x 12' wall faces the north and one 15' x 12' wall faces the west. The prevailing winter wind is from the northwest. The other two walls adjoin heated spaces. The 27' x 12' wall has five 5' x 3' windows and the 15' x 12' wall has two 5' x 3' windows. The walls are of 9" brick, furred, lathed and plastered. The attic is ventilated and the ceiling is lath and plaster on joists with gypsum fill between the joists. The attic has no flooring. The floor of the room is above a heated space. The local ordinance requires 30 cubic feet of outside air per minute per pupil.

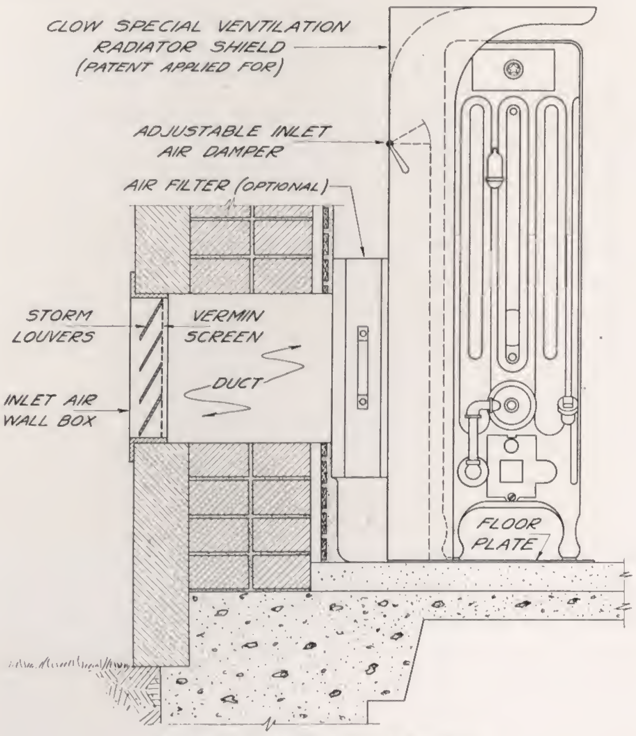
(A) HEAT LOSS CALCULATIONS:

Glass:	Sq. Ft. of Gasteam Radiation Required
Sq. ft. of single glass per sq. ft. of steam radiation required (Table II, line 3) 3.0 Area of glass equals 105 sq. ft. 105÷3=35 sq. ft. Add 15% for exposure to prevailing winter wind	40
Walls:	
Sq. ft. of wall per sq. ft. of steam radiation required (Table III, line 9-b) 16.4 Net area of walls equals 399 sq. ft. 399÷16.4=24.3. Add 15% for exposure to prevailing winter wind	28
Ceiling:	
Sq. ft. of ceiling per sq. ft. of steam radiation required (Table V, line 47-e) 30.3 Area of ceiling equals 405 sq. ft. 405÷30.3=	13.5
Gasteam radiation required for all heat loss except air change	81.5
Air Change:	
Since the room is to be heated from 0° to 70°, 10 sq. ft. of radiation per pupil will be required to warm the air required for ventilating. 20 pupils x 10 sq. ft. of radiation per pupil equals	200
Total Gasteam radiation required	281.5

Ordinarily, 20% would be added to the total radiation on account of heating in the daytime only. In this case, however, there are 200 sq. ft. of radiation for the sole purpose of heating the outside air. Since the outside air inlets do not need to be used until class time, this extra radiation may be used to bring the room temperature up to 70°.

(B) Register and Duct Sizes:

The total amount of outside air required for ventilation equals 20 pupils x 1800 cu. ft. of air per hour per pupil equals 36,000 cu. ft. per hour. Since the sizes of the outside air registers are recommended to be 200 square inches each, the number of registers required is 36,000 (the volume of outside air required) divided by 20,000 (the capacity of an outside air register for a 70° rise) equals 1.8. Therefore, two outside air registers will be required.



Air filter and Gasteam Radiator

To size of the exhaust register divide 36,000 (the volume of outside air required) by 21,000 (the capacity of the exhaust register in cu. ft. per hour per sq. ft. net area) equals 1.7 sq. ft. net area, or 245 sq. in.

The size of the exhaust duct is 36,000 (the volume of outside air required) divided by 36,000 (the capacity of the exhaust duct per sq. ft. area) equals 1 sq. ft.

To obtain the size of the fan required, the pressure drop through the outside air register, air filter, radiator enclosure, classroom, exhaust register and exhaust duct must be known. Assume that the total pressure drop is 1/4". Select from the catalogues of blower manufacturers the size blower which will deliver 36,000 cu. ft. of air per hour (or 600 cu. ft. per minute) at a static pressure of 1/4". From the over all dimensions of the blower selected, determine the size of the pent house to enclose the blower. Never use a propeller type of fan in connection with ducts.

RADIATOR SHIELDS ENCLOSURES AND RECESSES

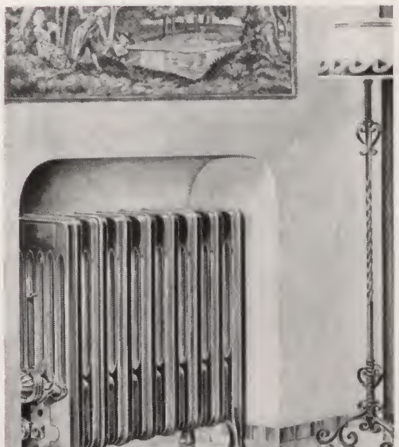
Radiator shields or enclosures on Clow Gasteam radiators make a very attractive looking installation, as may be seen in the illustrations. The Gasteam radiators may also be installed in recesses in the walls, and the recesses may be covered with grille work, or left open to suit individual taste. The advantage of installing Gasteam radiators in recesses is that floor space can be saved.

If the radiator shields or enclosures are of the proper design, they will not reduce the heat transmission of the Gasteam radiators.

The best designs of radiator shields or enclosures, from a heating standpoint, are those which least retard the air circulation over the Gasteam radiator. It has been determined by tests that the best type of enclosure is one which has vertical bars on the front and both ends of the enclosure with large air spaces between the bars. The back and top of the enclosures are solid, and the clearance between the top of the radiator and the bottom edge of the top front panel must be at least 1 in. If grille work is used instead of bars, then the grille work must have relatively large air spaces. The best type of radiator shield is one which has a back and top only. The clearance between the top of the radiator and the bottom edge of the top front panel must be at least 1 in. The backs of all shields and enclosures must extend down to the floor.

Ornamental enclosure useful also as shelf for books, etc.

Bathroom radiator with shield, partly recessed to save floor space.



Radiator recessed. Note sufficient space provided to light gas

Radiator in recess, concealed by perforated ornamental doors

SIMPLIFIED METHOD FOR CALCULATING STEAM RADIATION REQUIREMENTS

This is the Mills Rule Method using factors derived from the B. T. U. method.

Hot water radiation requirements may be obtained by increasing calculated steam requirements by 50%. 60%

There are five sources by which heat escapes from a building and for which radiation must be provided to offset in order to maintain an inside temperature warmer than the outdoor temperature.

These losses are as follows:

1. Heat loss due to air change.
2. " " " " conduction through windows and doors.
3. Heat loss due to conduction through cold walls.

(A wall is "cold" when the temperature on the opposite side is lower than that of the side facing the space to be heated.)

4. Heat loss due to conduction through floors.
5. " " " " " " ceilings or roofs or both.

An estimate of the amount of steam radiation required to offset each of these heat losses for a given enclosed space can be made by use of following tables.

To provide for the extra heat loss during abnormally windy cold days additional radiation should be provided. This should equal 15% of the radiation calculated for the two adjacent exposed walls and glass therein, which most nearly face prevailing winter winds

Radiation figures so obtained will provide ample heat to maintain a desired temperature inside the enclosed space when the anticipated outside weather conditions occur **only when continuous heat is maintained.**

If heat is supplied only in the daytime 20% more radiation than is calculated for continuous heating should be provided in order that the desired temperature can be established quickly when heat is turned on.

If heat is supplied only one or two days a week 50% more radiation than is calculated for continuous heating should be provided in order to supply the relatively large amount of heat that the building material and furnishings will absorb during the heating up period.

For inside temperatures other than 70° F., multiply the radiation calculated for 70° F. by the constant immediately below the desired inside temperature in the following table.

Inside Temperature Desired	..	..		50	55	60
Multiplier	..	..		.61	.71	.80
Ins. Temp. De.	65	75	80	85	90	100
Multiplier	.89	1.11	1.24	1.37	1.52	1.86

For temperature rises other than those shown in tables on pages 37 and 38, multiply the radiation calculated from the figures in the 0° to 70° F. column by the constant immediately below the desired temperature rise in the following table.

Temp. Rise—Deg. F.	40	50	60	75	80
Multiplier	.57	.71	.86	1.07	1.14
Temp. Rise—Deg. F.	85	90	100	110	
Multiplier	1.21	1.29	1.43	1.57	

Figures shown in tables on pages 37 to 38 are based on coefficients published in the American Society of Heating and Ventilating Engineers Guide of 1928.

The equivalent radiation requirements for outside surfaces such as walls, windows, roofs, etc., are based on a 15-mile per hour wind velocity. The figures for inside walls, floors, ceilings, etc., are based on still air on both sides of the material.

Air changes to assume in the following classes of buildings:

Residences—1 to 2, depending on the amount of movable windows, in relation to the wall area.

Stores and Factories—2 to 3, depending on the amount of ventilation. If exhaust fans are employed, use the capacity of the fans as the basis of air change.

Churches and Assembly Halls—1 to 3, based on 1200 cu. ft. of air entering the room per hr. per occupant, or as specified, or as required by state laws or local ordinances.

TABLE I. RADIATION REQUIRED FOR AIR CHANGE

Line	Air changes per hour	Cubic Feet of Space Heated per Sq. Ft. of Steam Radiation	
		0° to 70° F.	+20° to 70°F.
1	One air change	180	253
2	Two air changes	90	127

TABLE II. RADIATION REQUIRED FOR WINDOWS AND DOORS

		Sq. Ft. of Glass or Door per Sq. Ft. of Steam Radiation	
		0° to 70° F.	+20° to 70° F.
3	Single Glass	3.0	4.2
4	" " with storm sash	7.6	10.7
5	Enclosed Display Windows with glass or wood backing not ventilated. Use area of window	7.6	10.7
5-a	When ventilated, use area of backing	3.0	4.2
6	Wood doors with glass or thin wood panels	3.0	4.2
7	1" Solid wood doors	6.1	8.6
8	2" Solid wood doors	9.0	12.7

TABLE III. RADIATION REQUIRED FOR OUTSIDE WALLS

BRICK CONSTRUCTION

Line	Construction	Sq. Ft. of Wall per Sq. Ft. of Steam Radiation	
		0° to 70° F.	+20° to 70° F.
9	9" Brick Wall—Plain.........	9.6	13.5
9-a	Plaster Inside.............	10.6	14.9
9-b	Furred, Lath & Plaster Inside	16.4	23.1
10	13" Brick Wall—Plain.........	12.4	17.5
10-a	Plaster Inside.............	13.0	18.3
10-b	F. L. & Plaster............	19.2	27.0
11	18" Brick Wall—Plain.........	15.6	22.0
11-a	Plaster Inside.............	16.4	23.1
11-b	F. L. & Plaster Inside......	22.7	32.0
12	24" Brick Wall—Plain.........	19.6	27.6
12-a	Plaster Inside.............	20.8	29.3
12-b	F. L. & Plaster Inside......	27.0	38.0

ONE COURSE BRICK VENEER ON HOLLOW TILE

13	On 4" Hollow tile, Plaster......	12.3	17.3
13-a	" 4" " " F.L.& Plaster	18.5	26.0
14	" 6" " " Plaster......	13.9	19.6
14-a	" 6" " " F.L.& Plaster	20.0	28.2
15	" 8" " " Plaster......	14.9	21.0
15-a	" 8" " " F.L.& Plaster	21.3	30.0
16	" 12" " " Plaster......	20.4	28.7
16-a	" 12" " " F.L.& Plaster	26.3	37.0

ONE COURSE BRICK VENEER ON CONCRETE

17	On 6" Concrete—Plain........	8.9	12.5
17-a	" 6" " Plaster......	9.6	13.5
17-b	" 6" " F.L.& Plaster	15.6	22.0
18	" 8" " Plain........	9.6	13.5
18-a	" 8" " Plaster......	10.4	14.6
18-b	" 8" " F.L.& Plaster	16.4	23.1
19	" 12" " Plain........	11.4	16.1
19-a	" 12" " Plaster......	12.0	16.9
19-b	" 12" " F.L.& Plaster	18.2	25.6

ONE COURSE BRICK VENEER ON FRAME CONSTRUCTION

20	On Sheathing, stud, lath & plaster..................	15.9	22.4
20-a	With ½" felt or quilt between studding.................	27.8	39.2
20-b	With Gypsum fill between studding.................	34.5	48.6
21	On ½" Fiber board, stud, ½" fiber board and plaster.....	22.7	32.0
22	On ⅜" Plaster board, stud, ⅜" plaster board and plaster...	13.2	18.6

STUCCO ON HOLLOW TILE

23	On 6" Hollow tile, Plaster......	11.5	16.2
23-a	" 6" " " F.L.& Plaster	17.9	25.2
24	" 8" " " Plaster......	12.5	17.6
24-a	" 8" " " F.L.& Plaster	18.5	26.0
25	" 12" " " Plaster......	17.9	25.2
25-a	" 12" " " F.L.& Plaster	23.8	33.5

4" CUT STONE VENEER ON BRICK, HOLLOW TILE, OR CONCRETE

Line	Construction	Sq. Ft. of Wall per Sq. Ft. of Steam Radiation	
		0° to 70° F.	+20° to 70° F.
26	On 9" Brick—Plaster.........	12.2	17.2
26-a	" 9" " F. L. & Plaster...	18.2	25.6
27	" 13" " Plaster.........	14.7	20.7
27-a	" 13" " F. L. & Plaster...	20.8	29.3
28	" 6" Hollow tile—Plaster.....	12.7	17.9
28-a	" 6" " " F.L.& Plaster	18.9	26.6
29	" 8" " " Plaster......	13.7	19.3
29-a	" 8" " " F.L.& Plaster	19.6	27.6
30	" 12" " " Plaster......	18.9	26.6
30-a	" 12" " " F.L.& Plaster	25.0	35.2
31	" 6" Concrete—Plaster......	8.2	11.5
31-a	" 6" " F.L.& Plaster	14.3	20.1
32	" 12" " Plaster......	10.6	14.9
32-a	" 12" " F.L.& Plaster	16.7	23.5

SOLID CONCRETE WALLS—STUCCO FINISH OUTSIDE

(Use the same figures for Plain Concrete Walls.) Limestone or sandstone in place of concrete, increase the calculated radiation 10%. Cinder concrete requires approximately 10% less radiation than stone concrete.

33	6" Concrete—No inside finish..	6.7	9.4
33-a	With plaster inside..........	7.4	10.4
33-b	" F. L. & Plaster inside..	13.5	19.0
34	10" Concrete—No inside finish.	7.9	11.1
34-a	With plaster inside..........	8.7	12.3
34-b	" F. L. & Plaster inside...	14.7	20.7
35	16" Concrete—No inside finish.	10.4	14.6
35-a	With plaster inside..........	11.1	15.6
35-b	" F. L. & Plaster inside..	17.2	24.2

CONCRETE BLOCK WALLS

36	6" Concrete Block—Plaster inside.......................	8.4	11.8
36-a	6" Cinder Concrete Block—Plaster inside..............	12.9	18.2
36-b	6" Concrete Block—F. L. & Plaster inside..............	14.5	20.4
36-c	6" Cinder Concrete Block—F. L. & Plaster.............	19.0	26.7
37	12" Concrete Block—Plaster inside......................	12.7	17.9
37-a	10" Cinder Concrete Block—Plaster inside..............	18.7	26.3
37-b	12" Concrete Block—F. L. & Plaster inside..............	18.9	26.6
37-c	10" Cinder Concrete Block—F. L. & Plaster.............	24.8	34.9

FRAME WALLS

Wood shingles figured same as clapboard

38	Clapboard, sheathing stud, lath & plaster...................	15.2	21.4
38-a	With ½" felt or quilt between studs.....................	26.3	37.0
38-b	With Gypsum fill between studs.....................	34.5	48.6
39	Clapboard, ½" fiber board, stud, ½" fiber board & plaster......	21.8	30.7
40	Clapboard, 1" fiber board, stud, ½" fiber board & plaster......	27.0	38.0
41	Stucco, sheathing, stud, lath & plaster....................	13.3	18.7
41-a	With ½" felt or quilt between studs.....................	25.0	35.2
42	Stucco, ⅜" plaster board, stud, ⅜" plaster board & plaster...	10.5	14.8

TABLE IV. INSIDE WALLS

Line	Construction	Sq. Ft. of Wall per Sq. Ft. of Steam Radiation 0° to 70° F.	+20° to 70° F.
43	Stud, lath and plaster one side . .	6.9	9.7
43-a	Stud, lath and plaster both sides	13.7	19.3
44	Stud, ½" fiber board and plaster one side	11.0	15.5
44-a	Stud, ½" fiber board and plaster both sides	22.2	31.2
45	4" Hollow tile plastered one or two sides	11.1	15.6
46	4" Hollow Gypsum tile plastered one or two sides	19.6	27.6

TABLE V. CEILINGS WITH VENTILATED AIR SPACE AND ROOF ABOVE

(See also Floors Table VI)

If air space above ceiling is entirely enclosed from outside air circulation, and unheated, use twice the area shown as equivalent to a sq. ft. of radiation. (Taking twice the area provides half the radiation).

Line	Construction	Sq. Ft. of Ceiling Area per Sq. Ft. of Steam Radiation 0° to 70° F.	+20° to 70° F.
47	Lath and plaster on joists—no floor above	6.8	9.6
47-a	With single floor above	14.7	20.7
47-b	" double floor above	16.9	23.8
47-c	" ½" felt or quilt between joists—no floor above	18.2	25.6
47-d	With ½" felt or quilt between joists—single floor above . . .	26.3	37.0
47-e	" Gypsum fill between joists—no floor above	30.3	42.7
47-f	" Gypsum fill between joists—single floor above . . .	33.3	46.9
48	½" Fiber board and plaster on joists—no floor above	11.1	15.6
48-a	With single floor above	18.9	26.6
48-b	With ½" fiber board and floor above	23.8	33.5
49	Steel on joists—no floor above . .	5.1	7.2
49-a	With single floor above	12.9	18.2
49-b	" double floor above	15.2	21.4

For Hollow tile and Gypsum see inside walls.

TABLE VI. FLOORS

(See also Table V.)

Line	Construction	Sq. Ft. of Floor Area per Sq. Ft. of Steam Radiation: On Earth 50° F. Ground Temperature Assumed	With Ventilated air space below. Use twice the area shown per sq. ft. of radiation when air space is entirely enclosed from outside circulation. 0° to 70° F.	+20° to 70° F.
50	Single wood floor on joists	26.9	7.8	11.0
50-a	With battleship linoleum or similar	35.5	10.3	14.5
51	Double wood floor on joists	34.8	10.1	14.2
51-a	With battleship linoleum or similar	43.5	12.0	17.7
52	4" Concrete	14.7	6.8	9.6
52-a	4" Concrete with single wood floor .	24.1	9.4	13.2
52-b	4" Concrete with double wood floor	32.3	11.8	16.6
52-c	4" Concrete with 1" Terrazzo or tile . .	15.9	7.1	10.0
52-d	4" Concrete with 1" Terrazzo or Tile on 3" Cinder concrete	22.7		
52-e	4" Concrete with 3" Cinder Concrete .	21.7		
52-f	With single wood floor	31.2		

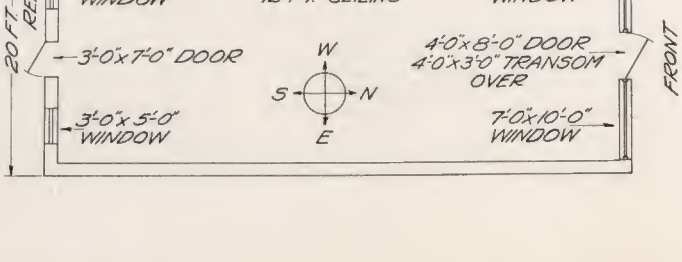
TABLE VII. ROOFS IMMEDIATELY ABOVE HEATED ENCLOSURES

Line	Construction	Sq. Ft. of Roof Area per Sq. Ft. of Steam Radiation 0° to 70° F.	+20° to 70° F.
53	Wood shingles on wood strips on rafters	7.1	10.0
53-a	Wood shingles on wood strips on rafters, lath and plaster underneath rafters	13.9	19.6
53-b	53-a with ½" soft felt or quilt between the rafters	25.0	35.2
53-c	53-a with Gypsum fill between rafters	34.5	48.6
54	Asphalt or rigid asbestos shingles, composition roofing, slate or tile on roofing felt on wood sheathing require approximately the same amount of radiation as wood shingles on strips		
55	2" Concrete—Roofing above	5.2	7.3
55-a	With ½" fiber board underneath	10.4	14.6
55-b	2" Concrete with composition roofing and 2" fiber board	25.6	36.1
55-c	2" Concrete with 2" Cellular Gypsum and composition roofing	14.1	19.9
55-d	2" Concrete—F. L. & Plaster—roofing above . . . . Increased thickness in the concrete reduces the required radiation only slightly.	11.3	15.9
56	Composition Roofing on 1" Sheathing	7.0	9.9
56-a	Composition Roofing on 2" Sheathing	9.9	13.9
57	2" Cellular Gypsum added to (56)	16.1	22.7
58	Composition Roofing on Metal Roof Deck	4.4	6.2
58-a	With ½" fiber board between	9.6	13.5
58-b	With ½" soft felt or quilt between	10.7	15.1
59	Corrugated iron roof	2.3	3.2

EXAMPLE

1. STORE:

It is desired to heat a one story store without basement 50' long x 20' wide x 12' high from 0° to 70°. The front consists of two plate glass windows 7'x10', a glass door 4'x8' and a transom 3'x4'. The side walls, both exposed, have no windows. The rear wall has one door 3'x7' and two windows 3'x5'. The rear wall faces the south. The prevailing winter wind is from the northwest. See floor plan. The walls are all 13" brick furred, lathed and plastered. The floor is of 13-16" maple flooring on one inch wood subflooring on joists on earth. The roof is composed of roofing layed on 1" boards, joists, lath and plaster underneath.



ESTIMATE OF STEAM RADIATION REQUIRED FOR STORE

(Shown on Page 38)

AIR CHANGE—2 per hour	Sq. Ft. of Steam or Gasteam Radiation Required
Cubic feet of space heated per sq. ft. of steam radiation required 90. (Table I, line 2) Dimensions 50'x20'x12' = 12000 cu. ft. space to be heated-12000 ÷ 90 =	133

GLASS

Sq. Ft. of single glass or door per sq. ft. of steam radiation required 3.0 (Table II, line 3) North Windows 2 – 7'x10' = 140 sq. ft. 1 – 4'x 8' = 32 " " 1 – 3'x 4' = 12 " " 184 sq. ft. No west windows or doors 184 ÷ 3 = 61 + 15% for exposure to prevailing winter wind	70
South door 1 – 3'x7' = 21 sq. ft. and windows 2 – 3'x5' = 30 " " 51 sq. ft. 51 ÷ 3 =	17

WALLS

Sq. Ft. of exposed wall per sq. ft. of steam radiation required 19.2 (Table III, line 10-b) North Wall 20'x12' = 240 sq. ft. gross area 240 sq. ft. – 184 sq. ft. = 56 sq. ft. net area 56 ÷ 19.2 = 2.9 + 15% for exposure to prevailing winter wind	3.4
West Wall 50'x12' = 600 sq. ft. net area (no windows or doors) 600 ÷ 19.2 = 31.2 + 15% for exposure to prevailing winter wind	35.9
South Wall 20'x12' = 240 sq. ft. gross area 240 sq. ft. – 51 sq. ft. = 189 sq. ft. net area 189 ÷ 19.2 =	9.8
East Wall 50'x12' = 600 sq. ft. net area (no windows or doors) 600 ÷ 19.2 =	31.2

FLOOR

Sq. ft. of floor per sq. ft. of steam radiation required. 35.4 (Table V, line 51) Area = 50x20 = 1000 sq. ft. 1000 ÷ 35.4 =	28.2

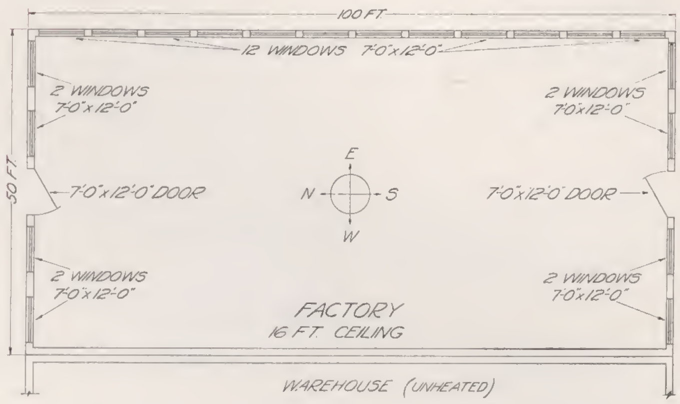
ROOF

Sq. ft. of roof per sq. ft. of steam radiation required. 6.8x2 = 13.6 (air space between ceiling and roof not ventilated) (Table IV, line 47) Area = 50x20 = 1000 sq. ft. 1000 ÷ 13.6 =	73.5
Sq. Ft. Radiation Required for continuous heating	402.0
20% additional radiation when heat is supplied during daytime only	80
Total Sq. Ft. Radiation Required	482.0

EXAMPLE

2. FACTORY:

It is desired to heat a factory building 100' long x 50' wide x 16' high from 0° to 70°. The walls are all 13" solid brick with no plaster finish. The floor is 4" concrete on 3" cinder concrete on earth. The roof is composed of roofing on 2" wood planks. In the north wall is a single solid wood door 2" thick and 7'x12' in area and also four windows of single glass 7'x12'. In the east wall there are 12 windows 7'x12'. In the south wall there is a single 2" solid wood door 7'x12' and 4 windows 7'x12'. The prevailing winter winds are from the north and west. The west wall has no openings. It adjoins a warehouse which is unheated. See floor plan.



ESTIMATE OF STEAM RADIATION REQUIRED

AIR CHANGE—2 per hour	Sq. Ft. of Steam or Gasteam Radiation Required
Cu. ft. of space heated per sq. ft. of steam radiation required 90. (Table I, line 2) Dimensions 50'x100'x16' = 80,000 cu. ft. space to be heated 80,000 ÷ 90 =	889

GLASS & DOORS

Sq. ft. of glass per sq. ft. of steam radiation required. 3.0 (Table II, line 3) Sq. ft. of doors per sq. ft. of steam radiation required. 9.0 (Table II, line 8) North Windows 4 – 7'x12' = 336 sq. ft. 336 ÷ 3 = 112 + 15% for exposure to prevailing winter winds	128.8
West Windows None South Windows 4 – 7x12' = 336 sq. ft. 336 ÷ 3 =	112
East Windows 12 – 7'x12' = 1008 sq. ft. 1008 ÷ 3 =	336.6
North Door 1 – 7'x12' = 84 sq. ft. 84 ÷ 9 = 9.3 + 15% for exposure to prevailing winter wind	10.7
South Door 1 – 7'x12' = 84 sq. ft. 84 ÷ 9 =	9.3

Estimate of Steam Radiation Required for Factory—Continued

WALLS

Sq. ft. of exposed wall per sq. ft. of steam radiation required. 12.4 (Table III, line 10) North Wall 50'x16' = 800 sq. ft. gross area 800 − 420 (windows and door) = 360 sq. ft. net area 360 ÷ 12.4 = 29 + 15% for exposure to prevailing winter wind................................	33.5
West Wall 100'x16' = 1600 sq. ft. net area (no doors or windows)................................ 1600 ÷ 12.4 = ...	129.0
(No exposure factor, account of adjoining warehouse) East Wall 100'x16' = 1600 sq. ft. gross area 1600 − 1008 (windows) = 592 sq. ft. net area 592 ÷ 12.4................................	47.6
South Wall 50'x16' = 800 sq. ft. gross area 800 − 420 (windows & door) = 380 sq. ft. net area 380 ÷ 12.4................................	30.6

FLOOR

Sq. ft. of floor per sq. ft. of steam radiation required 21.7 (Table VI, line 52) Dimensions 50'x100' = 5000 sq. ft. area 5000 ÷ 21.7 = ...	230

ROOF

Sq. ft. of roof per sq. ft. of steam radiation required. 9.9 (Table VII, line 56-a) Dimensions 50'x100' = 5000 sq. ft. area 5000 ÷ 9.9 = ...	505
Total sq. ft. of steam radiation required for continuous heating................................	2462.1
20% additional radiation when heat is supplied during daytime only................................	492.4
Total sq. ft. of steam radiation required...........	2954.5

EXAMPLE

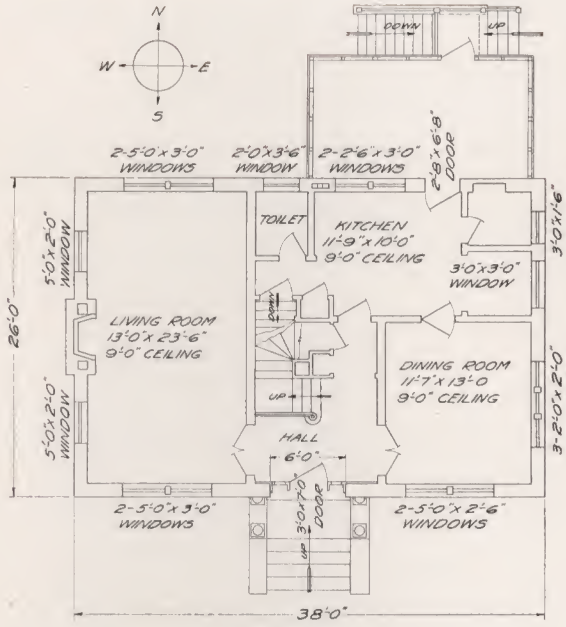
3. RESIDENCE:

It is desired to heat a two story residence without basement from 0° to 70°. Of course, each room is figured separately, and since the method of calculating is the same, the calculations for only one room on each floor will be shown as an example.

A. FIRST FLOOR:

CALCULATIONS FOR LIVING ROOM:

The living room is 23½' long x 13' wide x 9' high and is exposed on three sides. One of the 13' x 9' walls faces the north. Only one of the 23½'x9' walls is exposed and it faces the west. The north 13'x9' wall has two 5'x3' windows. The west wall has two 5'x2' windows, and the south wall has two 5'x3' windows. The walls are of 4" brick, sheathing, studding, lath and plaster. The floor is of double wood flooring on joists with ventilated air space beneath. There is a heated room above the ceiling. The prevailing winter winds are from the northwest.



FIRST FLOOR PLAN

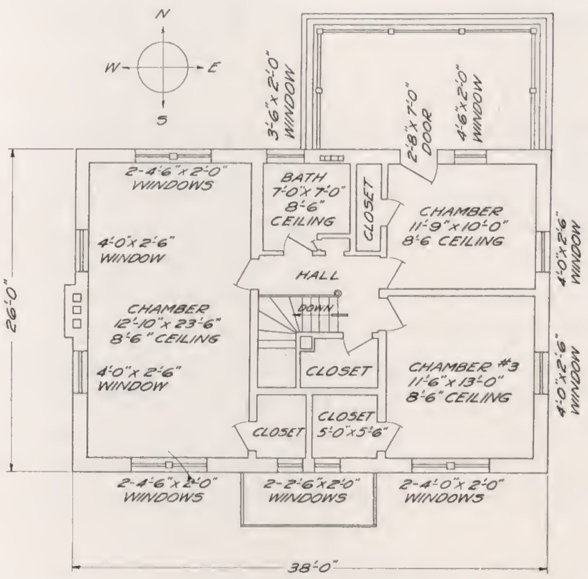
ESTIMATE OF STEAM RADIATION REQUIRED

AIR CHANGE—1 per hour	Sq. Ft. of Steam or Gasteam Radiation Required
Cu. ft. of space heated per sq. ft. of steam radiation required. 180 (Table I, line 1) Dimensions 23.5'x13'x9' = 2750 cu. ft. space to be heated 2750 ÷ 180................................	15.3
GLASS	
Sq. ft. of glass per sq. ft. of steam radiation required. 3.0 (Table II, line 3) North windows 2 − 5'x3' = 30 sq. ft. 30 ÷ 3 = 10 + 15% for exposure to prevailing winter winds................................	11.5
West Windows 2 − 5'x2' = 20 sq. ft. 20 ÷ 3 = 6.7 + 15% for exposure to prevailing winter winds................................	7.7
South windows 2 − 5'x3' = 30 sq. ft. 30 ÷ 3 = ...	10.0
East windows None	
WALLS	
Sq. ft. of exposed wall per sq. ft. of steam radiation required. (Table III, line 20) 15.9 North Wall 13'x9' = 117 sq. ft. gross area 117 − 30 (windows) = 87 sq. ft. net area 87 ÷ 15.9 = 5.5 + 15% for exposure to prevailing winter winds................................	6.3
West Wall 23.5'x9' = 212 sq. ft. gross area 212 − 20 (windows) = 192 sq. ft. net area 192 ÷ 15.9 = 12.1 + 15% for exposure to prevailing winter winds................................	13.9
South Wall 13'x9' = 117 sq. ft. gross area 117 − 30 (windows) = 87 sq. ft. net area 87 ÷ 15.9 = ...	5.5
East Wall not exposed	
FLOOR	
Sq. ft. of floor per sq. ft. of steam radiation required 10.1 (Table VI, line 51) (If space beneath floor were not ventilated, the figure 20.2 would be used instead of 10.1) Dimensions 23.5'x13' = 306 sq. ft. area. 306 ÷ 10.1 = ...	30.3
Total sq. ft. of steam radiation required for continuous heating................................	100.5

B. SECOND FLOOR:

CALCULATIONS FOR CHAMBER NO. 3 AND ADJOINING CLOSET:

Chamber No. 3 is 13' long x 11½' wide x 8½' high and is exposed on two sides. The clothes closet is 5½' long x 5' wide x 8½' high, and has only one exposure. The 13' x 8½' exposed chamber wall faces the east, and the 11½' x 8½' exposed chamber wall faces the south. The 5½' exposed closet wall faces the south. The east chamber wall has one 4'x2½' window and the south chamber wall has two 4'x2' windows. The south closet wall has one 2½'x2' window. The ceiling is of lath and plaster on joists with single attic flooring. The attic is ventilated. There is a heated room below the floor.



SECOND FLOOR PLAN

ESTIMATE OF STEAM RADIATION REQUIRED

AIR CHANGE—1 per hour	Sq. Ft. of Steam or Gasteam Radiation Required
Cu. ft. of space heated per sq. ft. of steam radiation 180 required. (Table I, line 1) Dimensions: Chamber 13'x11.5'x8.5' = 1271 cu. ft. Closet 5.5'x5'x8.5' = 234 cu. ft. 1505 cu. ft. space to be heated	
1505 ÷ 180 = ...	8.4

GLASS

Sq. ft. of glass per sq. ft. of steam radiation required. 3.0 (Table II, line 3) North Windows None West Windows None South Windows: Chamber 2 – 4'x2' = 16 sq. ft. Closet 1 – 2.5'x2' = 5 sq. ft. 21 sq. ft.	
21 ÷ 3 = ...	7.0
East Windows 1 – 4'x2.5' = 10 sq. ft.	
10 ÷ 3 = ...	3.3

WALLS

Sq. ft. of exposed wall per sq. ft. of steam radiation required. 15.9 (Table III, line 20) North Wall not exposed West Wall not exposed South Wall: Chamber 11.5'x8.5' = 98 sq. ft. Closet 5.5'x8.5' = 47 sq. ft. 145 sq. ft. gross area 145 – 21 (windows) = 124 sq. ft. net area	
124 ÷ 15.9 = ...	7.8
East Wall 13'x8.5' = 111 sq. ft. gross area 111 – 10 (windows) = 101 sq. ft. net area	
101 ÷ 15.9 = ...	6.4

CEILING

Sq. ft. of ceiling per sq. ft. of steam radiation required. 14.7 (Table V, line 47-a) (If attic were not ventilated, the figure 29.4 would be used instead of 14.7) Dimensions: Chamber 13'x11.5' = 150 sq. ft. Closet 5.5'x5' = 28 sq. ft. 178 sq. ft. area	
178 ÷ 14.7 = ...	12.1
Total sq. ft. of steam radiation required for continuous heating	45.0

TEST DATA ON AIR CONDITIONS, ETC.

Test Data

Several hundred thousand Clow Gasteam radiators are now in operation. Installations may be found in every section of the United States. Some of them have been used every winter for 25 years. Recognized and responsible organizations have made exhaustive tests on Clow Gasteam radiators either at the company's request or for various boards. Extracts of a few tests are given below. Complete copies of all tests or requirements are available for inspection.

American Gas Association Testing Laboratory

Every Clow Gasteam radiator now sold carries the Blue Star approval of the A. G. A. Testing Laboratory.

"This laboratory approval seal is a guarantee of compliance with basic national requirements for safety —American Gas Association, Inc."

These standards are determined by representatives of the American Gas Association, the U. S. Bureau of Standards, the U. S. Bureau of Mines, the U. S. Public Health Service and the Master Plumbers' Association. Copies of the A. G. A. approved requirements will be sent on request.

Underwriters Laboratories

The Testing Laboratories of
the National Board of Fire Underwriters

Clow Gasteam radiators are inspected by the Underwriters Laboratories and are listed by them as standard heating equipment. This means that Clow Gasteam radiators conform to the standards set by the Underwriters Laboratories.

Guide No. 141 A8 July 15, 1927—Laboratories' File MH244

Clow & Sons, James B., Mfr.
201-299 N. Talman Ave., Chicago, Ill.

Radiator, Gas Steam—With and Without Flue

Cast-iron steam radiators having automatically regulated gas burner underneath, enclosed in combustion chamber cast integrally with radiator sections. Used as independent source of heat or by special fittings, in connection with ordinary steam or hot water heating systems. Made in 3, 4 and 6 column styles.
Marking: "Gasteam" on brass name plate attached to end section.

STANDARD—Fire.

REEXAMINATION SERVICE.

See description of Reexamination Service on guide card, also General Information Card filed back of guide card.

This card replaces MH244 dated Oct. 12, 1923

Facsimile of Underwriters Laboratories Card

Test Made for City of Baltimore

June 6, 1923

Made by Earl S. Bishop, Jr., Chemists, to determine whether or not a Clow Gasteam radiator produced any carbon monoxide in a completely air tight room. The report to the city of Baltimore is as follows:

"A very rigid test, extending over a period of three hours, has been made of the performance of an eight-section three-column 38-inch high Clow Gasteam radiator. This test was made in a room of 1172 cu. ft. capacity as nearly air tight as it was physically possible to make it.

"Samples of the air of the room were drawn at the end of one hour and again at the end of the three-hour period. The results of the analysis of these samples showed that no carbon monoxide was produced.

....

"From this test, conducted in an air tight room in which there was no possibility of interchange of air from the outside, in which there was no production of carbon monoxide and no production of a disagreeable odor even at the end of three hours, one would certainly be warranted in the conclusion that there will be no production of carbon monoxide by this radiator when installed in the home.

"This test indicates that under ordinary usage this equipment is safe and in no way constitutes a gas hazard."

Very truly yours,
(Signed) EARL S. BISHOP, JR.

Excerpts from Smith Emery Test

January 2, 1923

Laboratory Certificate
SMITH-EMERY COMPANY
Chemical Engineers and Chemists
Metallurgical and Testing Engineers
245 South Los Angeles St.,
Los Angeles.

Laboratory
No. 45547

Sample Clow Gasteam radiator received.

"The room in which the test was made contained 2300 cubic feet of air space and 85 square feet of door and window space. The room also contained usual office equipment of desk, chairs, filing cabinets, etc. The walls were plastered and the floor covered with linoleum."

Before starting the test the room was well "aired" out. The windows and doors were then closed and all cracks and openings stopped up as well as possible." "At the conclusion of the test there was no noticeable odor in the room from the radiator."

"There was no carbon monoxide (CO) produced."

Respectfully submitted,

(Signed) SMITH-EMERY CO.

CHEMISTS & CHEMICAL ENGINEERS.

E. Vernon Hill Test

April, 1923.

EXCERPTS FROM TEST REPORT OF THE GASTEAM RADIATOR FOR

JAS. B. CLOW & SONS

Conducted primarily to determine if any carbon monoxide or other injurious gases or substances were liberated in sufficient quantities to be injurious to the health of occupants of a room heated by the above Clow Gasteam radiator.

Conducted in a room made as air tight as possible.

The method for determining the production of CO was air tests and blood analysis of six persons breathing the atmosphere of an air tight room for seven hours. The room was heated by two 4-column 12-section 38" unvented Clow Gasteam radiators in continuous operation. The room was 17'6" long x 16'3" wide, having a ceiling height of 13'6".

Analysis of the room air to determine the presence of CO were made over each Clow radiator, after periods of two hours each and at these periods also blood tests of each of the subjects for determining the presence of CO were made.

During the seven hours it was determined the air change in the room was slightly over ¾ of an air change an hour, which is less than that of ordinary dwelling rooms.

Results

(A) No carbon monoxide was given off by the two Clow Gasteam radiators tested; at least not in sufficient quantities to be detected in the air after seven hours of continuous operation, or in the blood of the subjects breathing the air during this entire period.

(B) No harmful or distressing physical effects could be detected in the subjects after the test was completed.

(C) All the factors influencing air conditions in an occupied space including dust content, bacterial content, odors, humidity, etc., were good, with the exception of the high temperature, made necessary by the conditions of the test.

E. VERNON HILL CO.
AEROLOGISTS
Chicago.

By E. V. Hill, M. D.
O. W. Armsbach, M. E.

Synopsis of Rice Institute Test

THE RICE INSTITUTE
Houston, Texas

Department of Chemistry

May 1, 1928

Test Made Upon Air in Room In Which An Unvented Clow Gasteam Radiator Has Been In Operation.

This test was made in a room in the Chemistry Building, 18'x18'x12¾' high, made as air tight as was practically possible. The test was conducted over a period of 7 hours, samples of the room air being taken and tested every half hour. The writer remained in the room during the entire period.

The heater used was a 4-column 10-section 38-inch unvented Clow Gasteam radiator. The gas pressure averaged 5.5 inches of water, the automatic gas regulator maintaining an average consumption of 12.5 cubic feet of natural gas per hour........................

Conclusions

1. At no time during the test was there an odor in the room coming from this radiator.

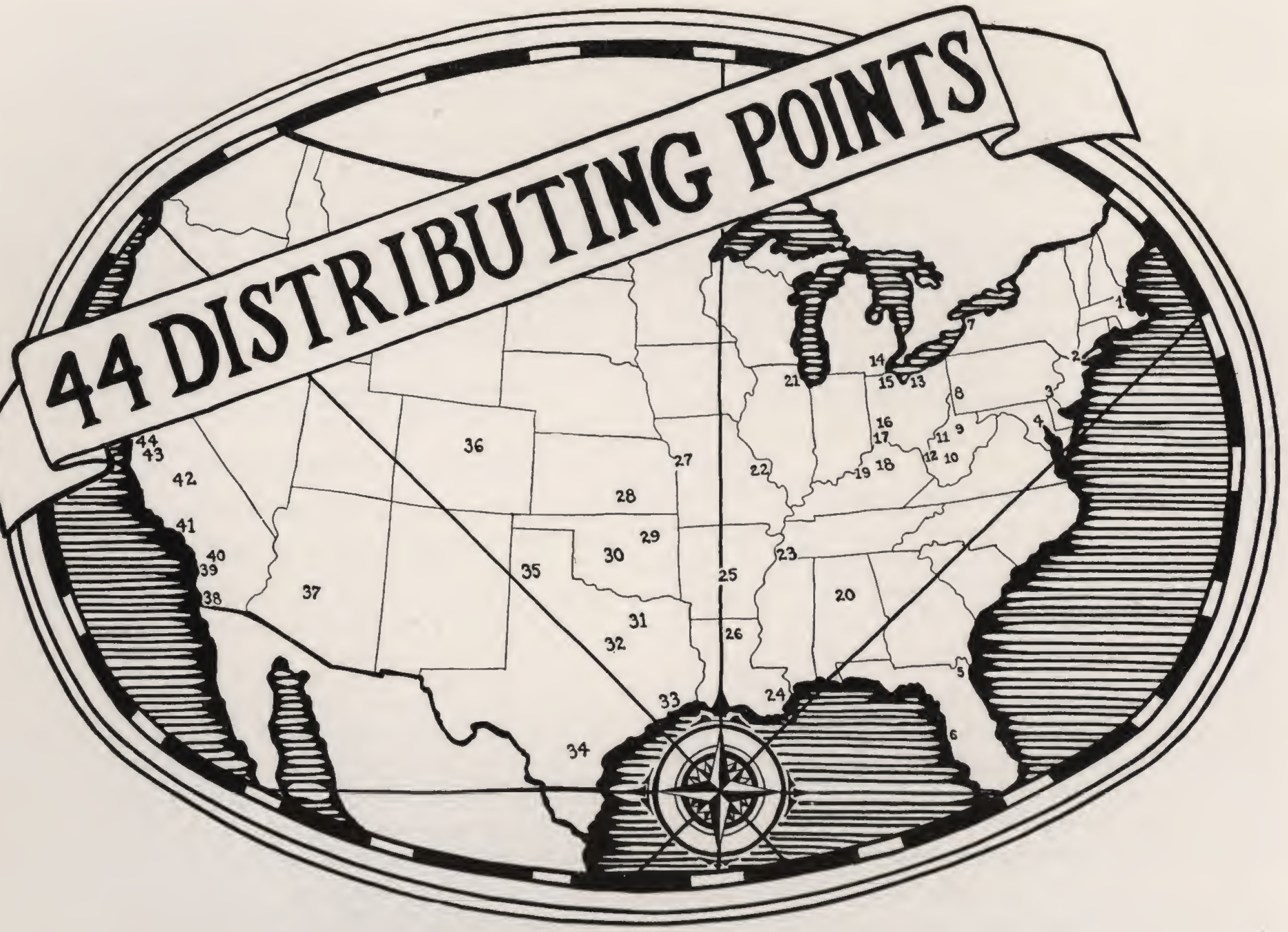
2. There was no carbon monoxide (CO) generated during the run.

3. In a second test made the following day under normal ventilating conditions it was found that the carbon dioxide (CO_2) content of the room was negligible, while the oxygen content was just about normal (20.8%).

The test indicates very clearly that the burning of this heater in a normally ventilated room can in no way endanger the occupants of the room.

Very truly yours,

(Signed) A. J. HARTSOOK
Chge. of Dept. of Chem. Eng.
The Rice Institute.



Amarillo, Tex.—The Gasteam Heating Company
Baltimore, Md.—The Gasteam Heating Company
Birmingham, Ala.—The Gasteam Heating Co.
Boston, Mass.—J. H. McPherson
Buffalo, N. Y.—J. F. Magee
Charleston, W. Va.—The Gasteam Heating Co.
Chicago, Ill.—The Gasteam Heating Company
Cincinnati, Ohio—F. J. Scull
Clarksburg, W. Va.—A. J. Phillips
Cleveland, Ohio—The Gasteam Heating Co.
Dallas, Texas—The Gasteam Heating Company
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Oklahoma City, Okla.—The Gasteam Radiator Co.
Parkersburg, W. Va.—The Gasteam Heating Co.
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Pittsburgh, Pa.—A. J. Phillips
San Antonio, Texas—The Gasteam Heating Co.
San Francisco, Calif.—The Gasteam Heating Co.
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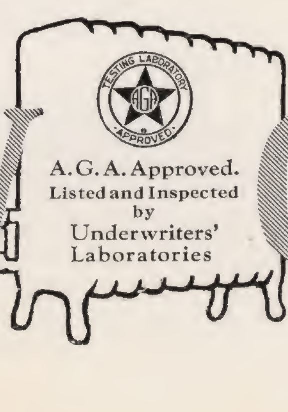
Tampa, Florida—The Gasteam Heating Company
Toledo, Ohio—Pioneer Plumbing & Heating Co.
Tulsa, Okla.—The Gasteam Radiator Company
Wichita, Kan.—The Gasteam Heating Company

Manufactured by
JAMES B. CLOW & SONS
201-299 North Talman Avenue
Chicago

CLOW GASTEAM



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